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FCC TEST REPORT

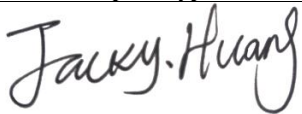
Under
FCC Part 15D for Isochronous UPCS Devices 1920–1930 MHz
☒ PUB_Part 15 Unlicensed PCS Base Station

Prepared For :

Aiphone Co., Ltd.

2-18, Jinno-cho, Atsuta-ku, Nagoya, Aichi, 456-8666, Japan

FCC ID: 2ALNEWLDAE1
EUT: Wireless Video Intercom - Video Door Station
Model: WL-DA.E1

July 28, 2018 Issue Date:
Original Report Report Type:
 Test Engineer: Jacky Huang
 Review By: Apollo Liu / Manager

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Table of Contents

1. General Information	4
1.1 Notes	4
1.2 Testing Laboratory	4
1.3 Details of Applicant	4
1.4 Application Details	4
1.5 Details of Manufacturer	4
1.6 Test Item	4
1.7 Applicable Standards	5
2. Technical Test	6
2.1 Summary of Test Results	6
2.2 Measurement Uncertainty	6
2.3 Antenna Requirement	6
2.4 Description of Tested Device	6
2.5 EUT Modification	6
3. Technical Characteristics Test	7
3.1 Conducted Emission Test	7
3.1.1 Test Equipment	7
3.1.2 Test Procedure	7
3.1.3 Test Setup	7
3.1.4 Configuration of the EUT	8
3.1.5 EUT Operating Condition	9
3.1.6 Conducted Power Line Emission Limits	9
3.1.7 Conducted Power Line Test Result	10
3.2 Emission Bandwidth & Occupied Bandwidth	11
3.2.1 Test Equipment	11
3.2.2 Test Procedure	11
3.2.3 Test Setup	11
3.2.4 Configuration of The EUT	11
3.2.5 EUT Operating Condition	11
3.2.6 Limit	11
3.2.7 Emission Bandwidth & Occupied Bandwidth	12
3.3 RF Output Power	15
3.3.1 Test Equipment	15
3.3.2 Test Procedure	15
3.3.3 Test Setup	15
3.3.4 Configuration of The EUT	15
3.3.5 EUT Operating Condition	15
3.3.6 Limit	15
3.3.7 RF Output Power Test Result	16
3.4 Power Spectral Density	18
3.4.1 Test Equipment	18
3.4.2 Test Procedure	18
3.4.3 Test Setup	18
3.4.4 Configuration of The EUT	18
3.4.5 EUT Operating Condition	18
3.4.6 Limit	18
3.4.7 Power Spectral Density Test Result	18
3.5 Emission Inside and Outside the Sub-band	22
3.5.1 Test Equipment	22
3.5.2 Test Procedure	22
3.5.3 Test Setup	22
3.5.4 Configuration of The EUT	22
3.5.5 EUT Operating Condition	22
3.5.6 Limit	22
3.5.7 Emission Inside and Outside the Sub-band Test Result	22
3.6 Radiated Spurious Emission	34
3.6.1 Test Equipment	34
3.6.2 Test Procedure	34
3.6.3 Test Setup	34
3.6.4 Configuration of The EUT	36
3.6.5 EUT Operating Condition	36
3.6.6 Limit	36
3.6.7 Radiated Spurious Emission Test Result	36
3.7 Carrier Frequency Stability	38
3.7.1 Test Equipment	38
3.7.2 Test Procedure	38
3.7.3 Test Setup	38
3.7.4 Configuration of The EUT	38
3.7.5 EUT Operating Condition	38
3.7.6 Limit	38
3.7.7 Frequency Stability Test Result	39
3.8 FCC§15.323 (c) (e) & §15.319(f) / RSS-213 Issue 3, clause 5.2– Specific Requirements for UPCS Device	40
4. Photos of Testing	48
4.1 Emission Test View	48
4.2 EUT Detailed Photographs	48
5. IC ID Label	49
6. Test Equipment	50

Report Revision History

Report #	Version	Description	Issued Date
KSZ2018062101JPP	Rev.01	Initial issue of report	July 28, 2018

1. General Information

1.1 Notes

The test results of this report relate exclusively to the test item specified in 1.6. The KMO Lab does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of the KMO Lab.

1.2 Testing Laboratory

Test Firm Name:	Ke Mei Ou Lab Co., Ltd.
Test Firm Address:	2013-2016, 20th Floor, Business Center, Jiahui Xin Cheng, No 3027, Shen Nan Road, Fu Tian, Shen Zhen, Guang Dong, P. R. China
FCC Designation Number:	CN1532
Test Firm Registration Number:	344480
Internet:	www.kmolab.com
Email:	kmo@kmolab.com
ANSI-ASQ National Accreditation Board/ACLASS ISO/IEC 17025 Accredited Lab for telecommunication standards. The Registration Number is AT-1532. The testing quality system meets with ISO/IEC-17025 requirements, This approval results is accepted by MRA of ILAC.	

1.3 Details of Applicant

Name: Aiphone Co., Ltd.
Address: 2-18, Jinno-cho, Atsuta-ku, Nagoya, Aichi, 456-8666, Japan

1.4 Application Details

Date of Receipt of Application: June 21, 2018
 Date of Receipt of Test Item: June 21, 2018
 Date of Test : June 21~July 28, 2018

1.5 Details of Manufacturer

Name: Shenzhen Guo Wei Electronics Co., Ltd.
Address: No. 3038, Luosha Road, Liantang, Luohu District, Shenzhen, Guangdong, China

1.6 Test Item

EUT Feature	
EUT Description:	Wireless Video Intercom - Video Door Station
Brand Name:	Aiphone
Model Name:	WL-DA.E1
EUT RF Technology:	☒ PUB Part 15 Unlicensed PCS Base Station
HW Version:	REV.0.2
SW Version:	V5702US
EUT Stage:	Identical Prototype
Note: The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.	

Standard Product Specification	
Tx/Rx Frequency Range	1921.536~1928.448 MHz
Number of Channels	5
Carrier Frequency of Each Channel	0_1928.448; 1_1926.720; 2_1924.992; 3_1923.264; 4_1921.536
Antenna Type / Gain	Internal Antenna / gain 0dBi
Type of Modulation	GFSK
EUT Operational Condition	☐ AC
	☐ DC → ☒ From Battery ☐ External AC adapter ☐ POE
	☒ Battery DC 3V (by 6 x AA Battery Cell)

1. 7 Applicable Standards

Applicable Standards
According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards: FCC Part 15, Subpart D ANSI C63.17-2013
Note: 1) All test items were verified and recorded according to the standards and without any deviation during the test. 2) This EUT has also been tested and complied with the requirements of FCC 15 Part 15, Subpart B, recorded in a separate test report.

2. Technical Test

2.1 Summary of Test Results

The EUT has been tested according to the following specifications:

FCC Rule FCC Part15, Subpart D	Test Type	Result	Notes
15.19(a)(3)	Labeling requirements	PASS	Complies
15.317, 15.203	Antenna Requirement	PASS	Complies
15.107(a), 15.207(a)	Power Line Conducted Emission	N/A	N/A
15.319(b)	Digital Modulation Techniques	PASS	Complies
15.303	Channel Frequencies	PASS	Complies
15.319(f)	Automatic discontinuation of transmission	PASS	Complies
15.323(f)	Carrier frequency stability	PASS	Complies
15.323(e)	Frame repetition stability	PASS	Complies
15.323(e)	Frame period and jitter	PASS	Complies
15.323(a)	Emission Bandwidth	PASS	Complies
N/A	Occupied Bandwidth	PASS	Complies
15.323(d)	In-band emissions	PASS	Complies
15.323(d)	Out-of-band emissions	PASS	Complies
15.319(c)(e), 15.31(e)	Output Power and Antenna Gain	PASS	Complies
15.319(d)	Power Spectral Density	PASS	Complies
15.323(c)(2)(5)(9)	Monitoring threshold, Least interfered channel	PASS	Complies
15.323(c)(1)	Monitoring of intended transmit window and maximum reaction time	PASS	Complies
15.323(c)(7)	Threshold monitoring bandwidth	PASS	Complies
15.323(c)(1)(5)(7)	Reaction time and monitoring interval	PASS	Complies
15.323(c)(4)(6)	Access criteria test interval	N/A	N/A, see note 1
15.323(c)(4)(6)	Access Criteria functional test	N/A	N/A, see note 1
15.323(c)(4)	Acknowledgements	PASS	Complies
15.323(c)(3)	Transmission duration	PASS	Complies
15.323(c)(10)	Dual access criteria	PASS	Complies
15.323(c)(11)(12)	Alternative monitoring interval	N/A	N/A, see note 2
15.319(g) 15.109(a), 15.209(a)	Spurious Emissions (Radiated)	PASS	Complies

1. Only applies for equipment that transmits unacknowledged control and signaling information

2. The client declares that the tested equipment does not implement this provision

2.2 Measurement Uncertainty

Measurement	Frequency	Uncertainty
Conducted emissions	0.15MHz~30MHz	1.72
Radiated emissions	30MHz ~ 300MHz	3.88
Radiated emissions	300MHz ~1000MHz	3.86
Radiated emissions	>1000MHz	4.42

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

2.3 Antenna Requirement

According to Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

The EUT no antenna connector for internal antenna. This is permanently attached antenna and meets the requirements of this section.

2.4 Description of Tested Device

The EUT is Door Camera PP Unit 1, Monitor FP Unit 1: Type 1 Wireless Video Door Phone

2.5 EUT Modification

No modification by test lab.

3. Technical Characteristics Test

3.1 Conducted Emission Test

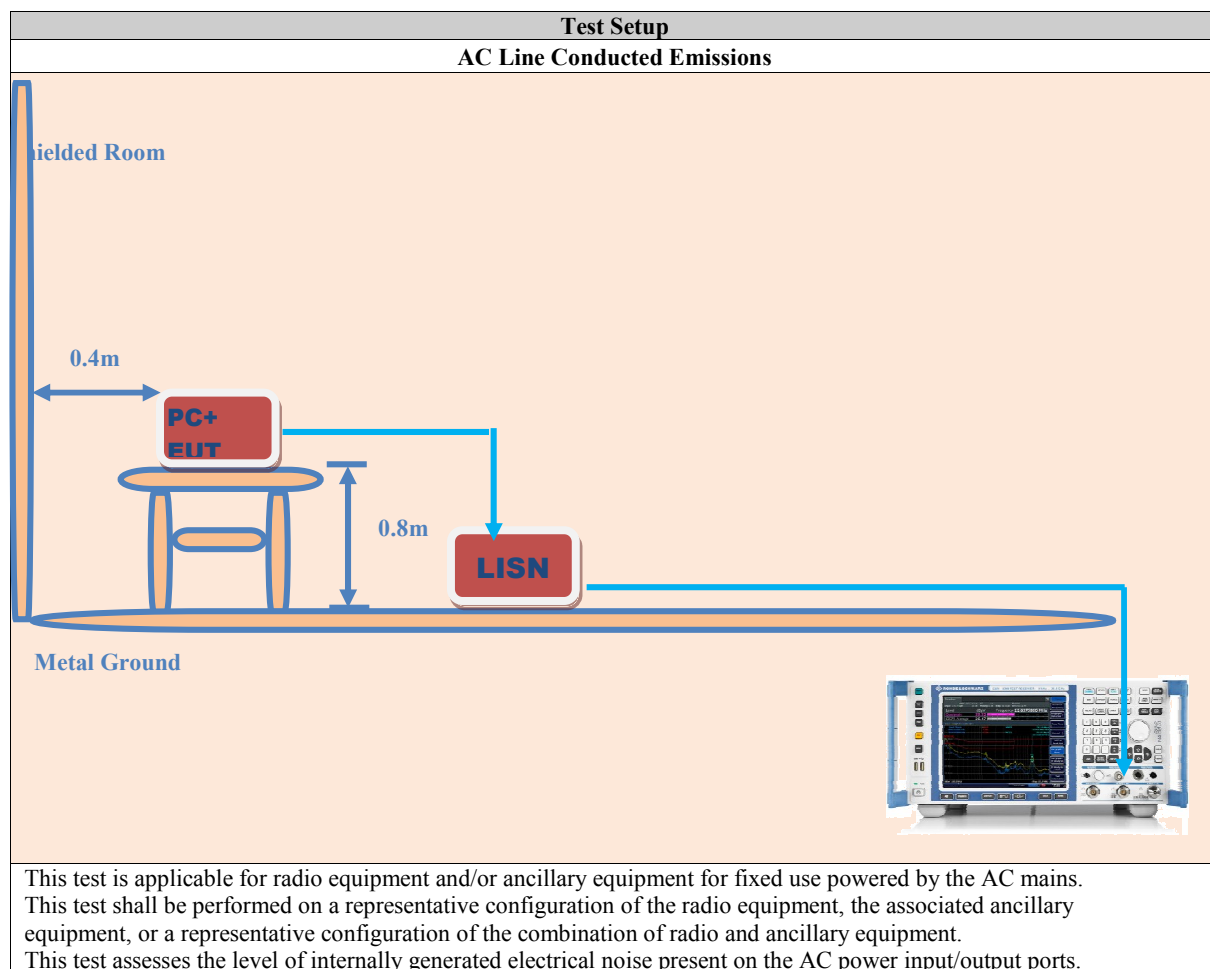
3.1.1 Test Equipment

Please refer to Section 6 this report.

3.1.2 Test Procedure

Test Method	
☒	The EUT and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50 ohm/50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission., the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.17:2013 on conducted measurement. Conducted emissions were investigated over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9kHz.

3.1.3 Test Setup



3.1.4 Configuration of the EUT

The EUT was configured according to ANSI C63.17:2013. All interface ports were connected to the appropriate peripherals. All peripherals and cables are listed below.

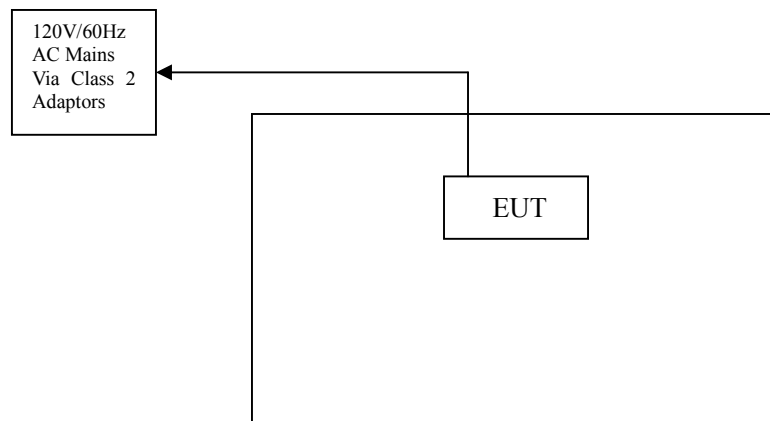
EUT Operation Test Setup	
Pre-Scan has been conducted to determine the worst-case mode from all possible combinations. Only the worst test mode data was reported.	
Pre-Scan Mode	
Test Mode	Operating Description
1	EUT power by Battery DC 3V (by 6 x AA Battery Cell)
-	-
Conducted Emissions → Final	
Test Mode	Operating Description
1	EUT power by Battery DC 3V (by 6 x AA Battery Cell)
-	-
Radiated Emissions → Final	
Test Mode	Operating Description
1	EUT power by Battery DC 3V (by 6 x AA Battery Cell)
Note: The test modes were carried out for all operation modes (include link and idle). The final test mode of the EUT was the worst test mode for Mode 1, and its test data was reported.	

Support Unit				
Device	Manufacturer	Model # Serial #	FCC ID	Cable
-	-	-	-	-

3.1.5 EUT Operating Condition

Operating condition is according to ANSI C63.17:2013.

- A. Setup the EUT and simulators as shown on follow.
- B. Enable RF signal and confirm EUT active.
- A. Modulate output capacity of EUT up to specification.



3.1.6 Conducted Power Line Emission Limits

FCC Part 15.207(a)

RSS-213 Clause 6.3, RSS-GEN Clause 8.8

Frequency Range (MHz)	Class A QP/AV (dBuV)	Class B QP/AV (dBuV)
0.15 – 0.5	79/66	66 –56/56 –46
0.5 – 5.0	73/60	56/46
5.0 – 30	73/60	60/50

Note: In the above table, the tighter limit applies at the band edges.

3.1.7 Conducted Power Line Test Result

EUT is power by battery only.

3.2 Emission Bandwidth & Occupied Bandwidth

3.2.1 Test Equipment

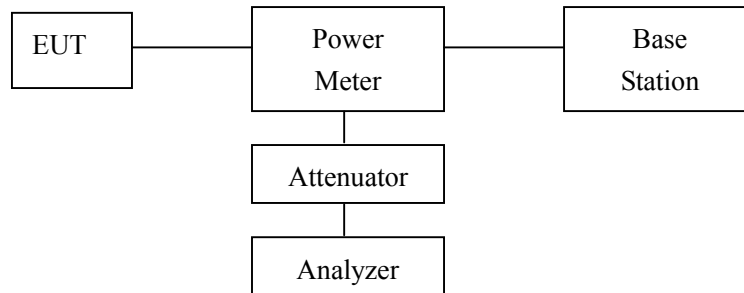
Please refer to section 6 this report.

3.2.2 Test Procedure

The width, in Hz, of the signal between two points, one below the carrier center frequency and one below the carrier center frequency, that is 26 dB down relative to the maximum level of the modulated carrier. It is based on the use of measurement instrumentation employing a peak detector function with an instrument resolution bandwidth approximately equal to 1% of the emission band-width of the device under measurement. [Extraction from 47 CFR 15, subpart D, 15.303 (C)]..

3.2.3 Test Setup

The emission bandwidth is measured in accordance with ANSI C63.17 sub-clause 6.1.3 using the setup below:



3.2.4 Configuration of The EUT

Same as section 3.1.4 of this report

3.2.5 EUT Operating Condition

Same as section 3.1.5 of this report

3.2.6 Limit

Requirements, FCC 15.323(a), RSS-213 Issue 3, clause 5.5:

The Emission Bandwidth B shall be larger than 50 kHz and less than 2.5 MHz.

No requirements for 6 and 12 dB Bandwidth, these values are only used for testing Monitoring Bandwidth if the Simple Compliance test fails (ANSI C63.17, clause 7.4).

RSS-GEN Issue 5, clause 6.7:

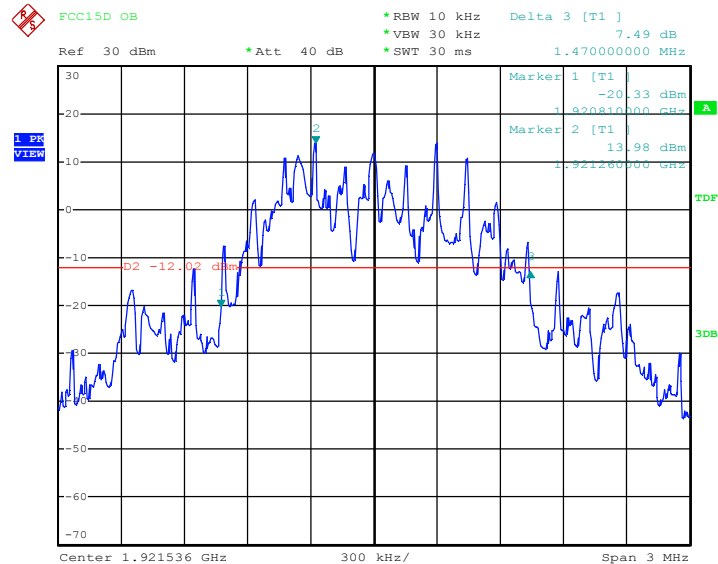
Occupied Bandwidth (99%) is measured according to RSS-GEN Issue 5, clause 6.7. No requirement specified.

3.2.7 Emission Bandwidth & Occupied Bandwidth

PP

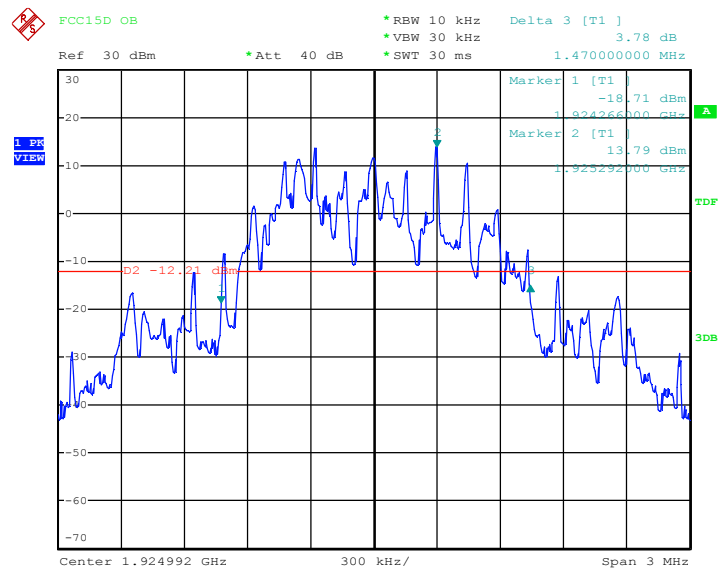
Channel	Center Frequency (MHz)	26 dB Emission Bandwidth (MHz)	Limit
Low	1921.536	1.470	50 kHz < OBW < 2.5 MHz
Middle	1924.992	1.470	50 kHz < OBW < 2.5 MHz
High	1928.448	1.470	50 kHz < OBW < 2.5 MHz

Low Channel



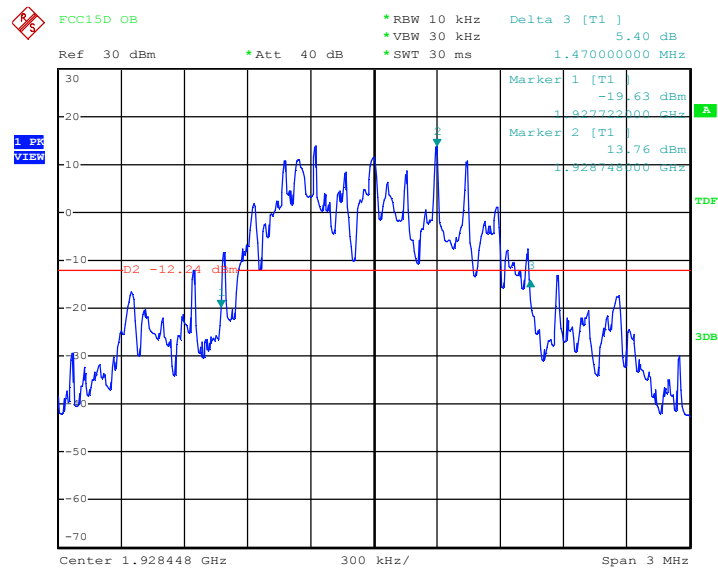
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Mid Channel



Date: 27.JUL.2018 09:50:22

High Channel



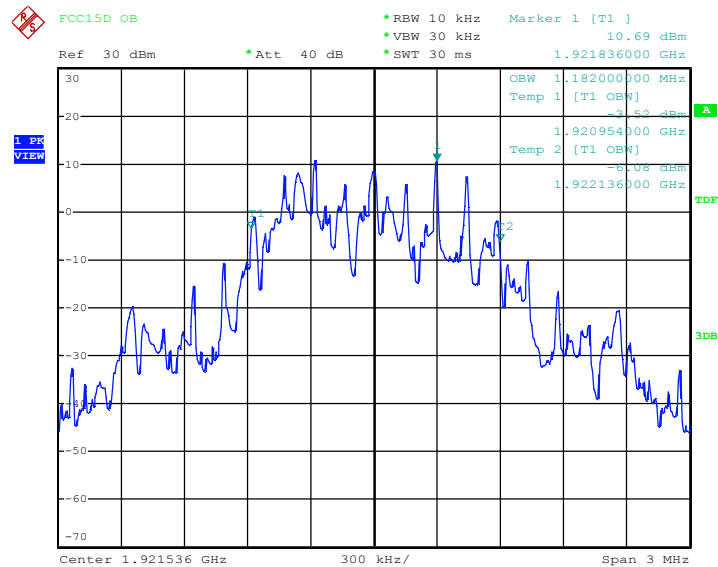
Date: 27.JUL.2018 09:47:25

PP

Channel	Center Frequency (MHz)	99% Occupied Bandwidth (MHz)	Limit
Low	1921.536	1.182	N/A
Middle	1924.992	1.176	N/A
High	1928.448	1.170	N/A

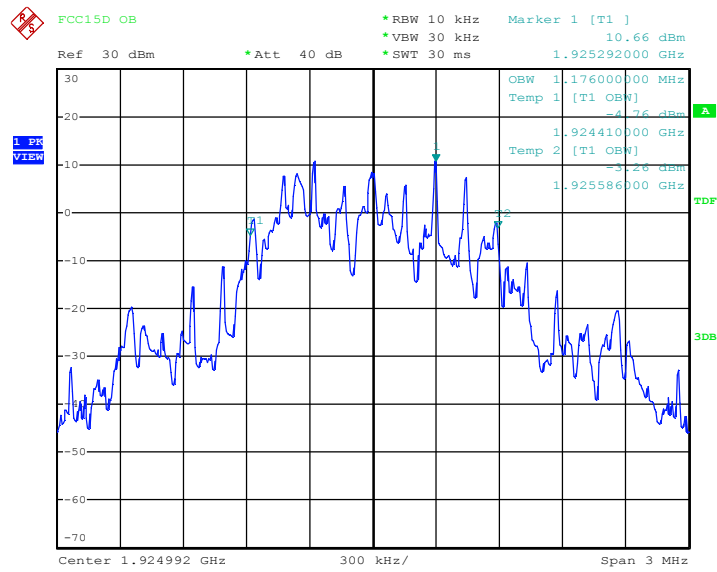
99% Occupied Bandwidth

Low Channel



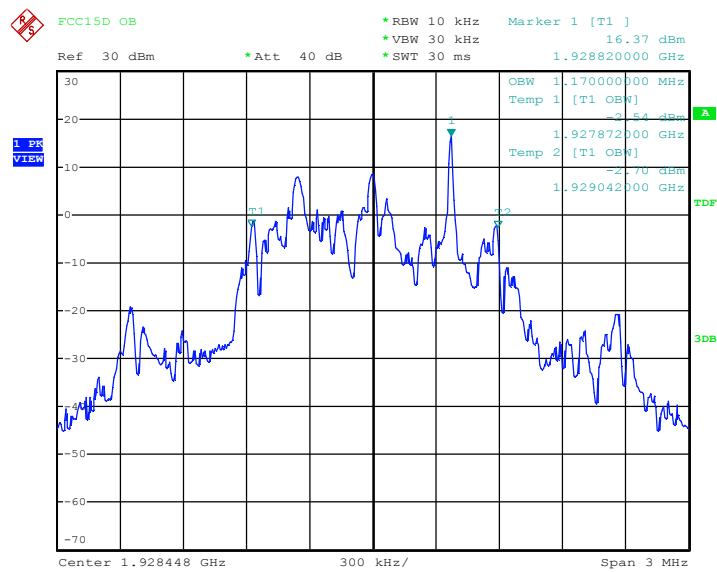
Date: 26.JUL.2018 10:17:17

Mid Channel



Date: 26.JUL.2018 10:15:12

High Channel



Date: 26.JUL.2018 10:13:24

3.3 RF Output Power

3.3.1 Test Equipment

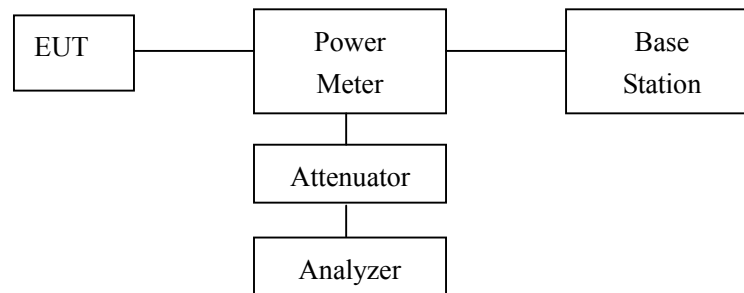
Please refer to section 6 this report.

3.3.2 Test Procedure

The peak power output as measured over an interval of time equal to the frame rate or transmission burst of the device under all conditions of modulation. Usually this parameter is measured as a conducted emission by direct connection of a calibrated test instrument to the equipment under test. If the device cannot be connected directly, alternative techniques acceptable to the Commission may be used [47 CFR 15, subpart D, 15.303].

The peak transmit power is according to ANSI C63.17 §6.1.2

3.3.3 Test Setup



3.3.4 Configuration of The EUT

Same as section 3.1.4 of this report

3.3.5 EUT Operating Condition

Same as section 3.1.5 of this report

3.3.6 Limit

FCC 15.319(c)(e):

Peak transmit power shall not exceed 100 microwatts multiplied by the square root of the Emission Bandwidth in Hertz. RSS-213 Issue 3, clause 5.6:

Peak transmit power shall not exceed 100 microwatts multiplied by the square root of the Occupied Bandwidth in Hertz. FCC 15.319(c)(e); RSS-213 Issue 3, clause 5.6:

The peak transmit power shall be reduced by the amount in decibels that the maximum directional gain of the antenna exceeds 3 dBi.

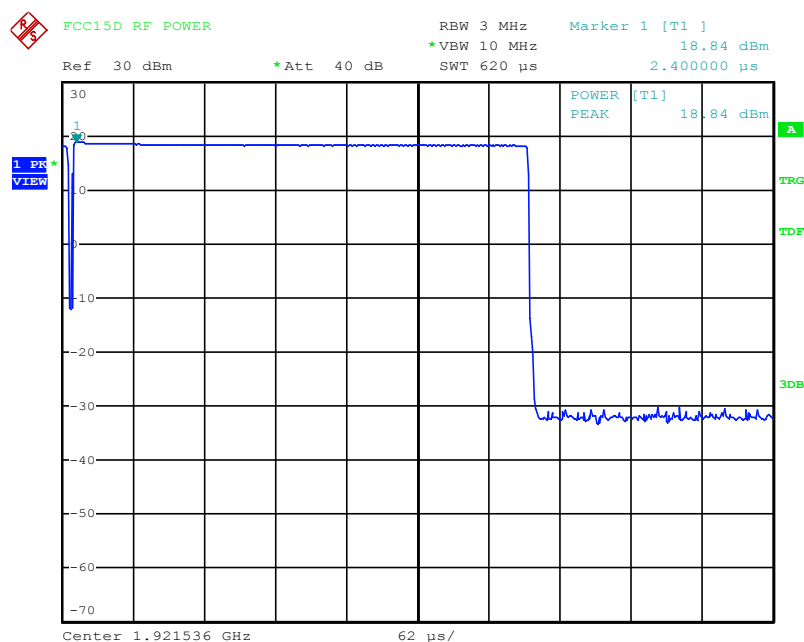
3.3.7 RF Output Power Test Result

PP

Channel	Frequency (MHz)	Peak Transmit Power (dBm)	FCC/RSS Limit (dBm)
Low	1921.536	18.84	20.84 / 20.36
Middle	1924.992	18.69	20.84 / 20.35
High	1928.448	18.54	20.84 / 20.34

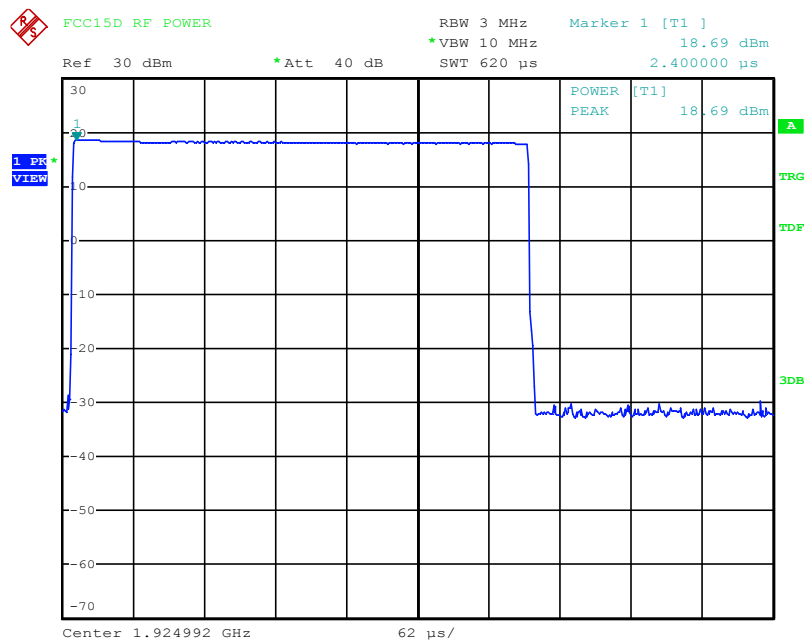
Conducted Peak Transmit Power Limit: $100 \mu\text{W} \times \text{SQRT}(B)$ where B is measured Emission BW or Occupied BW in Hz

Low Channel



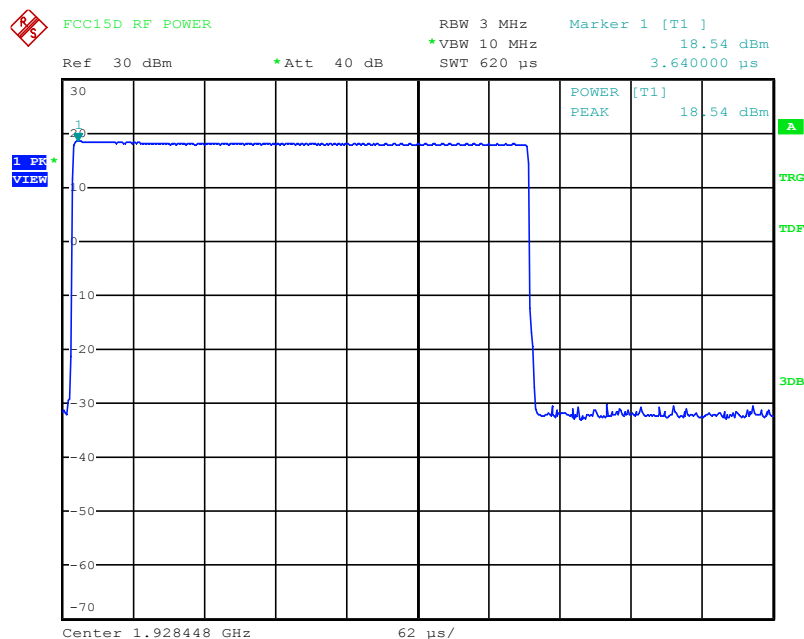
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Mid Channel



Date: 26.JUL.2018 10:20:44

High Channel



Date: 26.JUL.2018 10:21:50

3. 4 Power Spectral Density

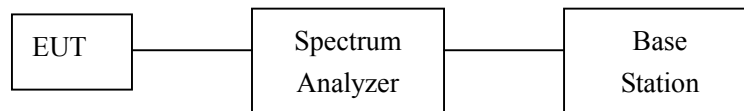
3.4.1 Test Equipment

Please refer to section 6 this report.

3.4.2 Test Procedure

The power spectral density is measured in accordance with ANSI C63.17 Clause 6.1.5.

3.4.3 Test Setup



3.4.4 Configuration of The EUT

Same as section 3.1.4 of this report

3.4.5 EUT Operating Condition

Same as section 3.1.5 of this report

3.4.6 Limit

Requirements, FCC 15.319(d), RSS-213 Issue 3, clause 5.7

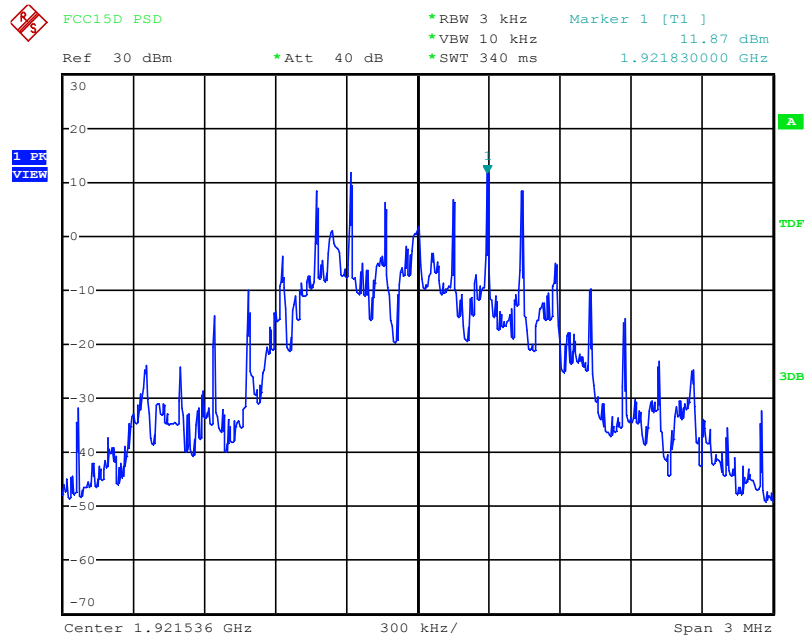
The Power Spectral Density shall be less than 3 mW (4.77 dBm) when averaged over at least 100 sweeps.

3.4.7 Power Spectral Density Test Result

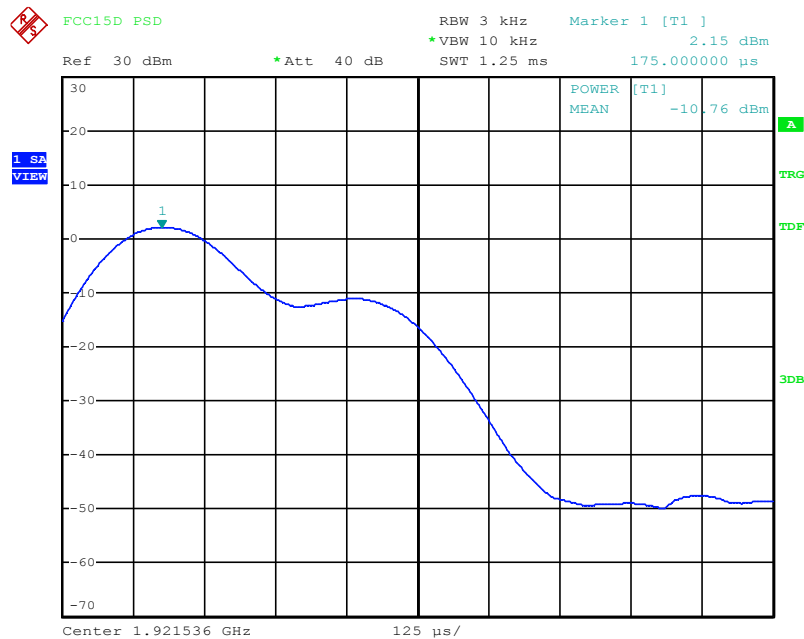
PP

Channel	Frequency(MHz)	Power Spectral Density		Limit(mW/3kHz)	Result
		(dBm/3kHz)	(dBm/3kHz)		
Low	1921.536	11.87	-10.76	3mW/4.77dBm	Pass
Middle	1924.992	12.28	-11.82	3mW/4.77dBm	Pass
High	1928.448	11.42	-12.02	3mW/4.77dBm	Pass

Low Channel

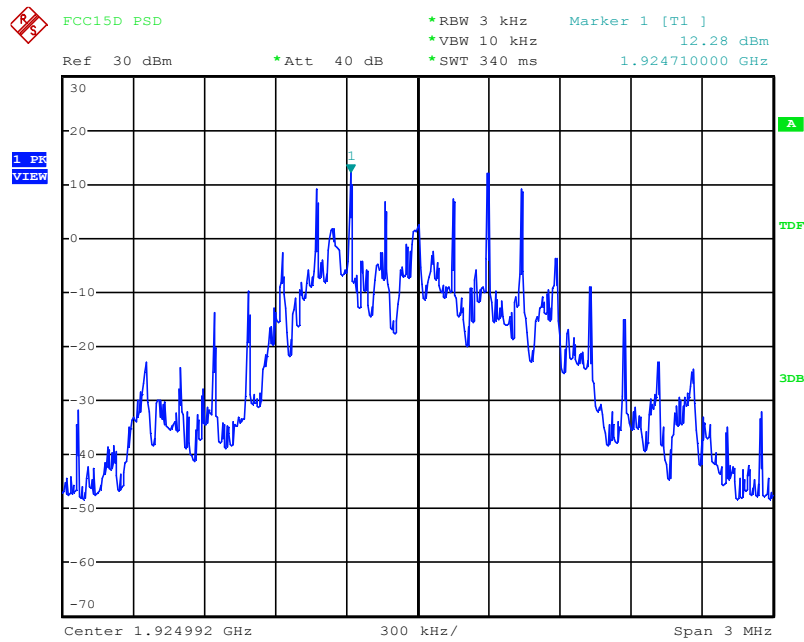


Date: 26.JUL.2018 10:25:20

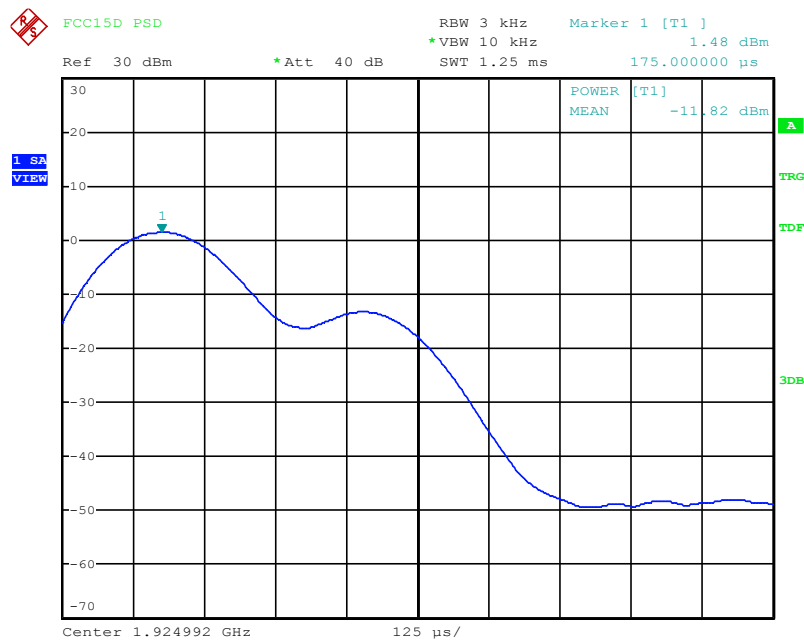


Date: 26.JUL.2018 10:26:39

Mid Channel

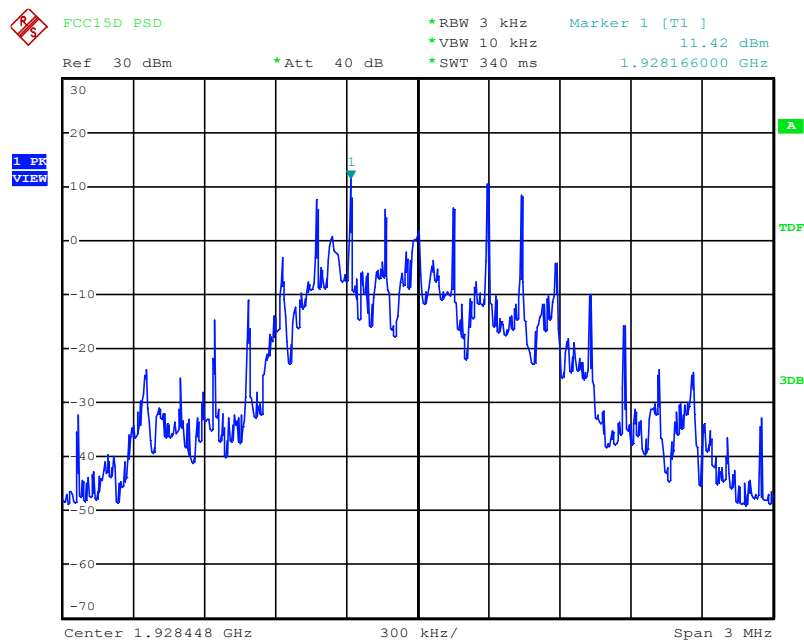


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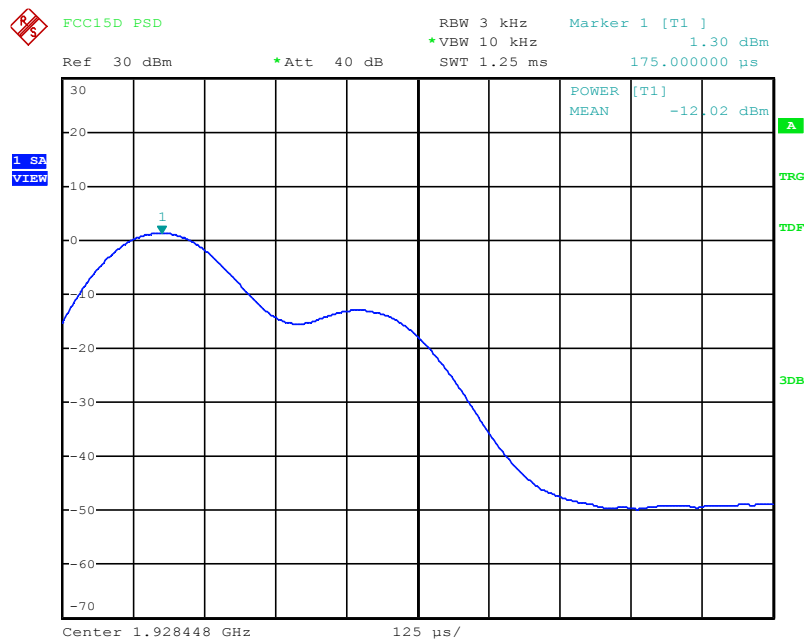


Date: 26.JUL.2018 10:29:20

High Channel



Date: 26.JUL.2018 10:30:52



Date: 26.JUL.2018 10:32:11

3.5 Emission Inside and Outside the Sub-band

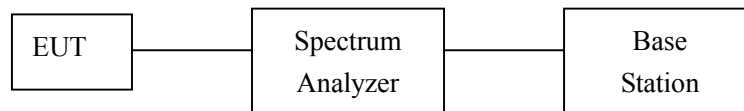
3.5.1 Test Equipment

Please refer to section 6 this report.

3.5.2 Test Procedure

According to ANSI C63.17 Clause 6.1.6.

3.5.3 Test Setup



3.5.4 Configuration of The EUT

Same as section 3.1.4 of this report

3.5.5 EUT Operating Condition

Same as section 3.1.5 of this report

3.5.6 Limit

In-Band Unwanted Emissions, Conducted

Requirements, FCC 15.323(d), RSS-213 Issue 3, clause 5.8.2:

$B < f \leq 2B$: at least 30 dB below max. permitted peak power

$2B < f \leq 3B$: at least 50 dB below max. permitted peak power

$3B < f \leq$ UPCS Band Edge : at least 60 dB below max. permitted peak power

Out-of-band Emissions, Conducted

Requirements, FCC 15.323(d), RSS-213 Issue 3, clause 5.8.1:

$f \leq 1.25\text{MHz}$ outside UPCS band : $\leq -9.5\text{dBm}$

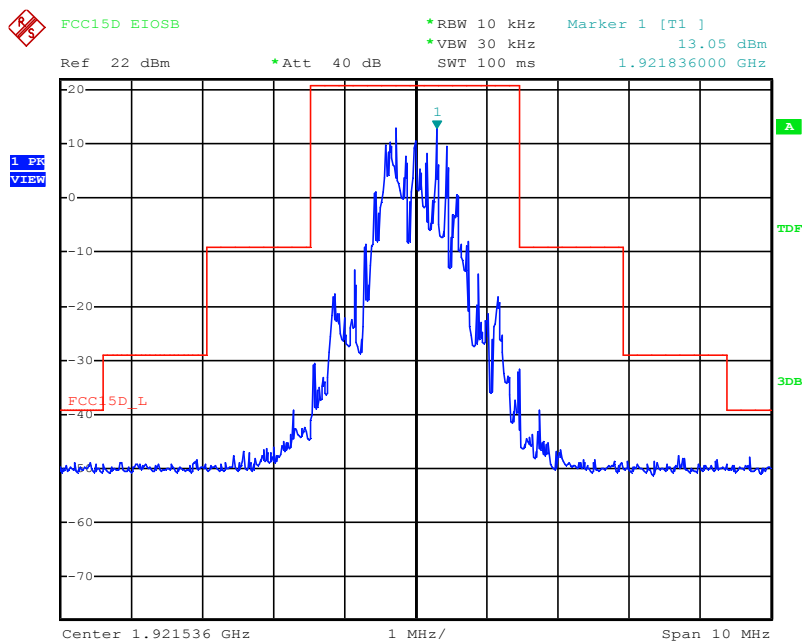
$1.25\text{MHz} \leq f \leq 2.5\text{MHz}$ outside UPCS band : $\leq -29.5\text{ dBm}$

$f \geq 2.5\text{MHz}$ outside UPCS band : $\leq -39.5\text{ dBm}$

3.5.7 Emission Inside and Outside the Sub-band Test Result

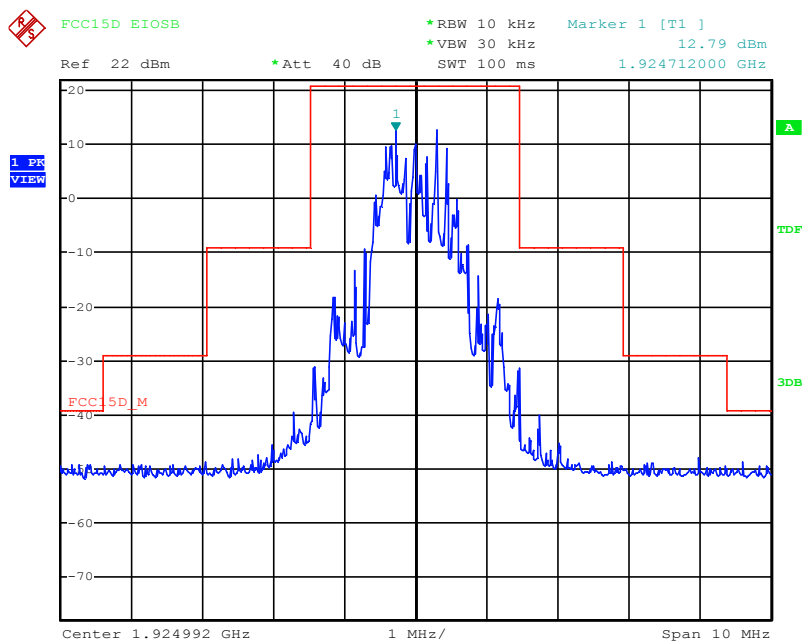
PP

Low Channel (Unwanted Emission inside the Sub-band)



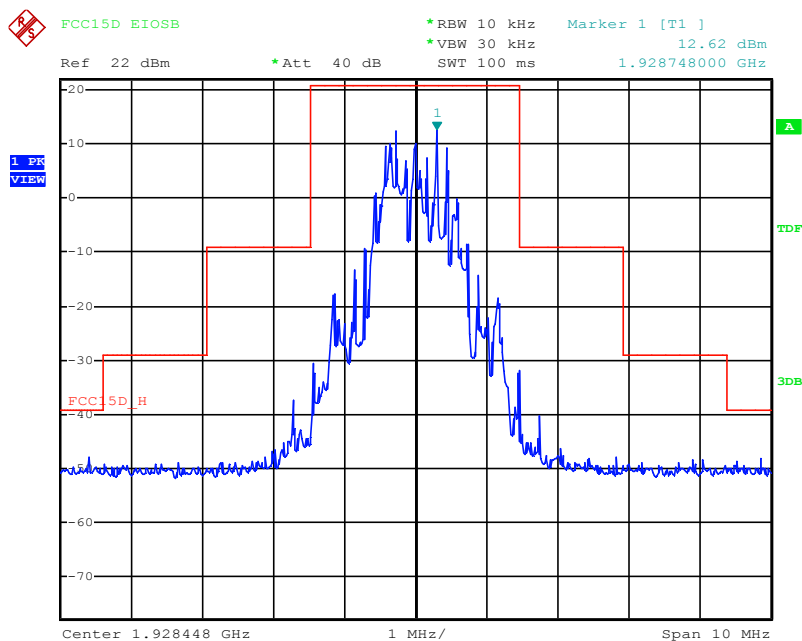
Date: 26.JUL.2018 12:22:47

Middle Channel (Unwanted Emission inside the Sub-band)



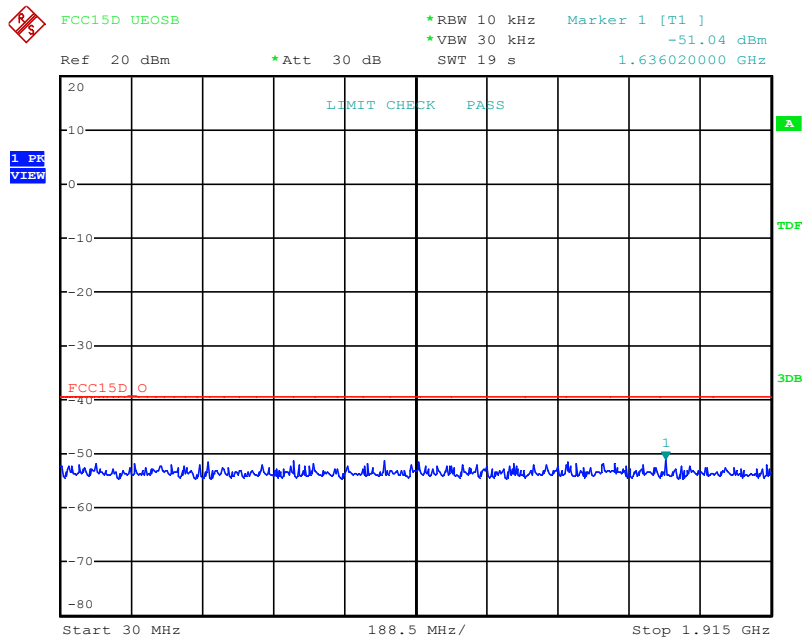
Date: 26.JUL.2018 12:20:09

High Channel (Unwanted Emission inside the Sub-band)

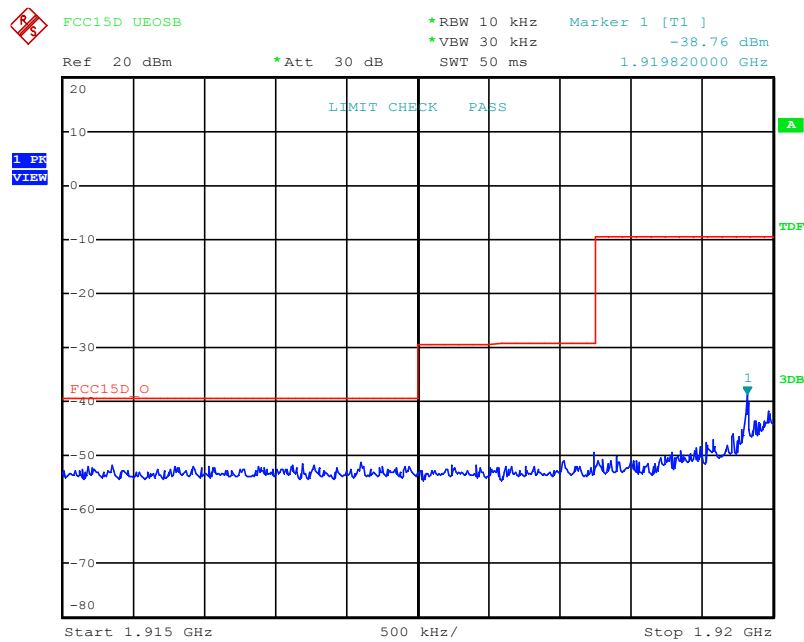


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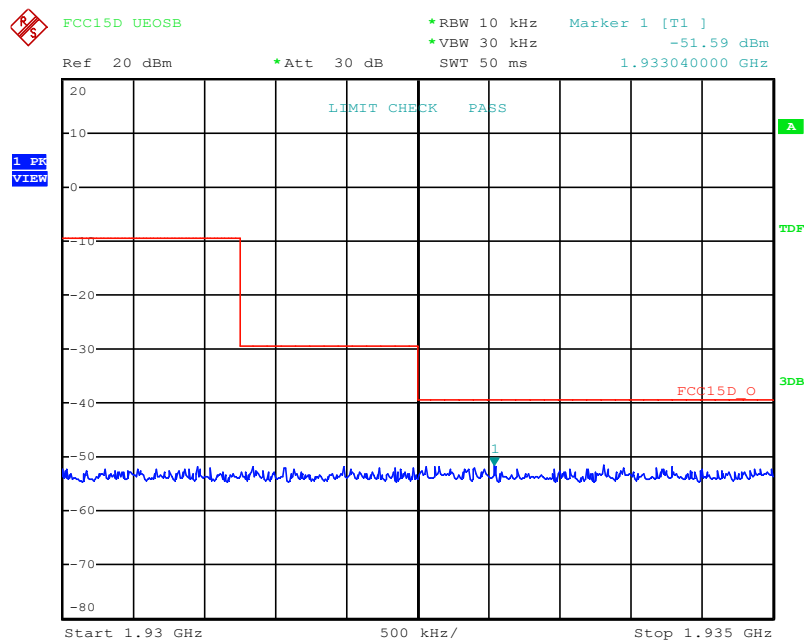
Low Channel (Unwanted Emission outside the Sub-band)



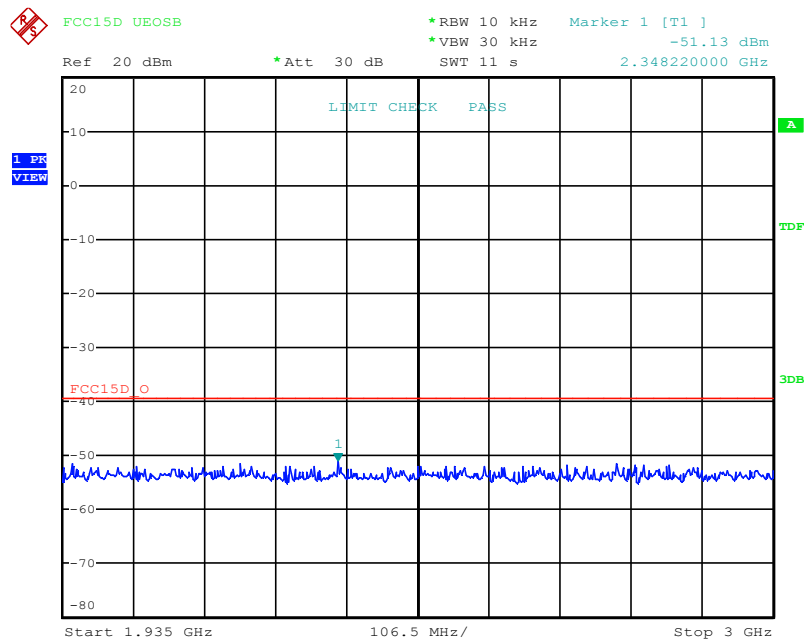
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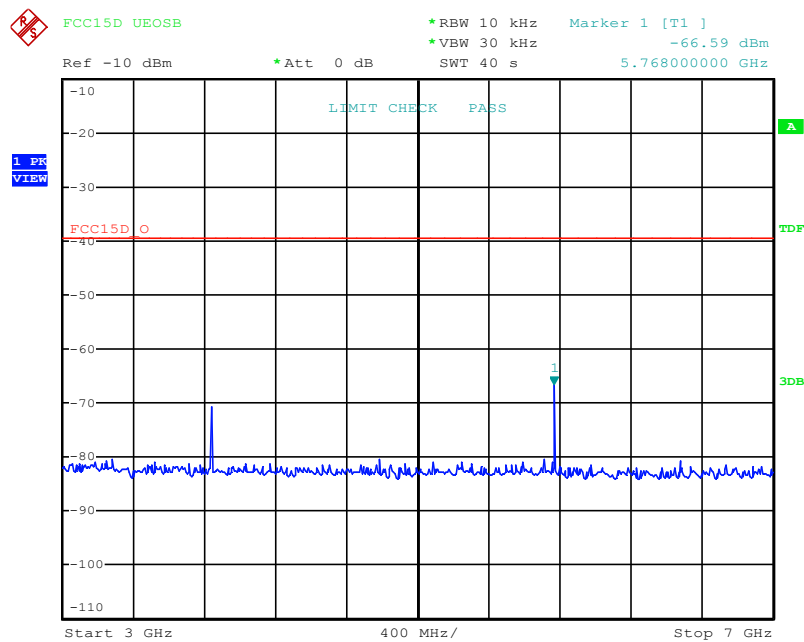
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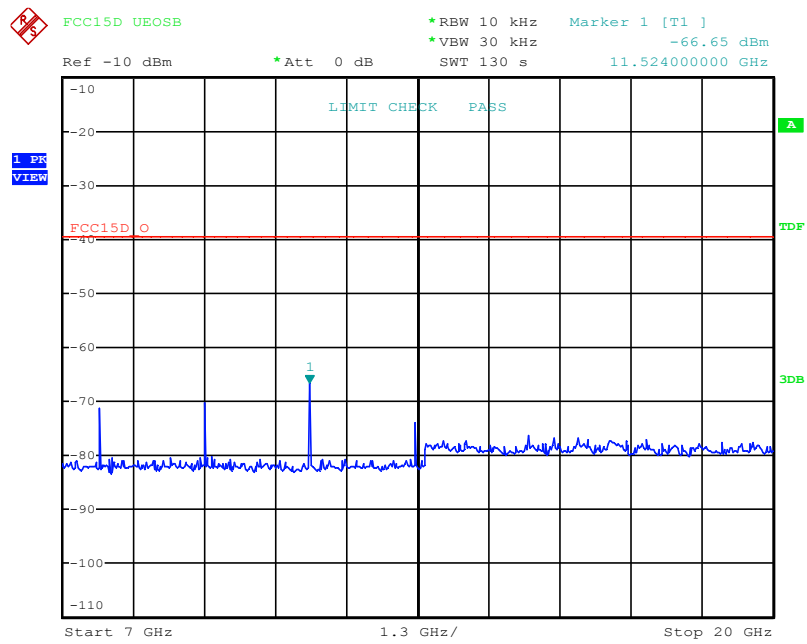
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Date: 26.JUL.2018 12:08:57

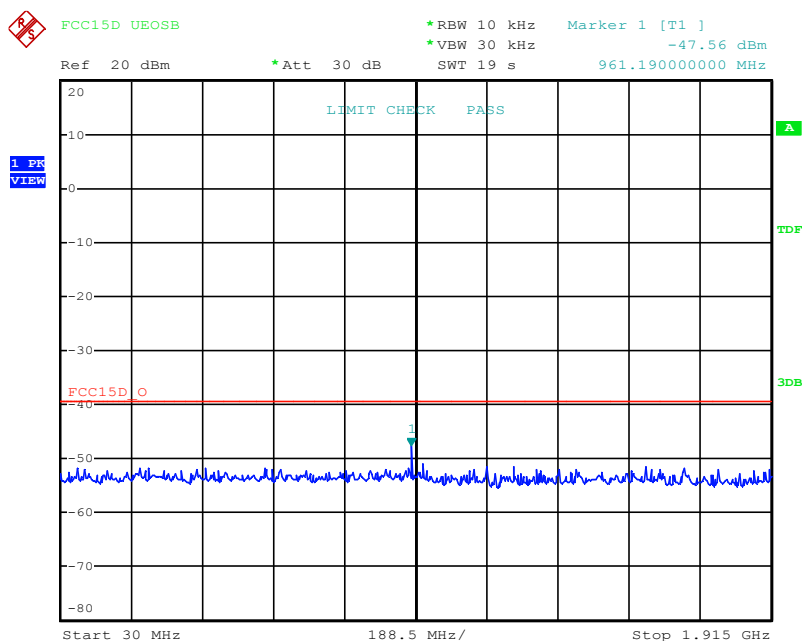


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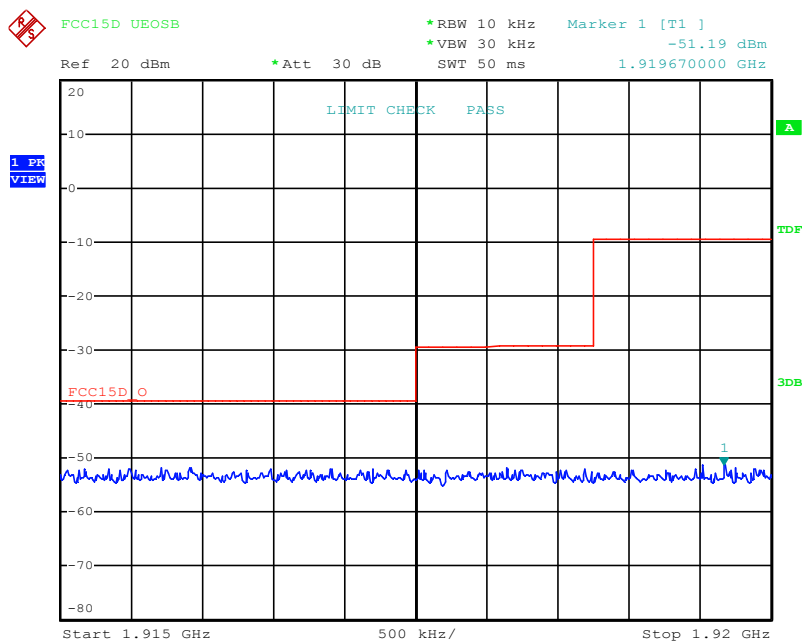


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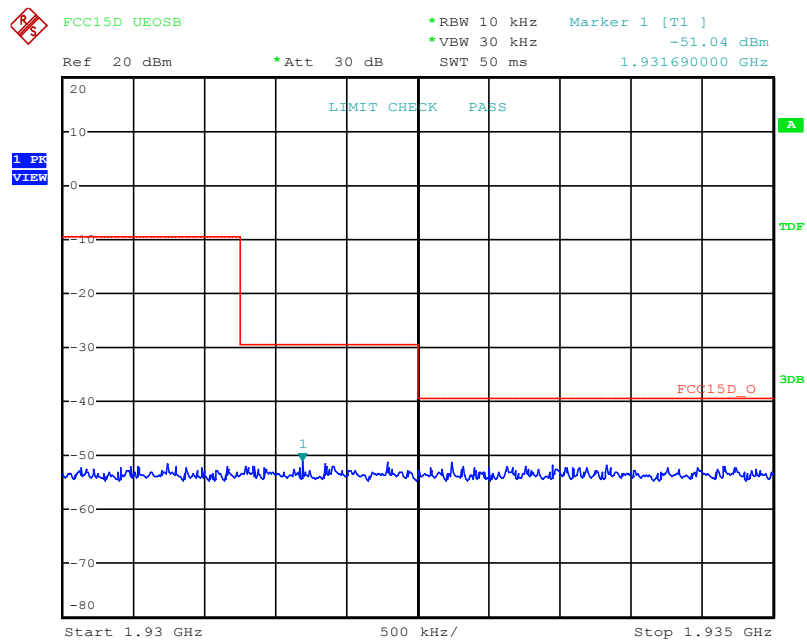
Middle Channel (Unwanted Emission outside the Sub-band)



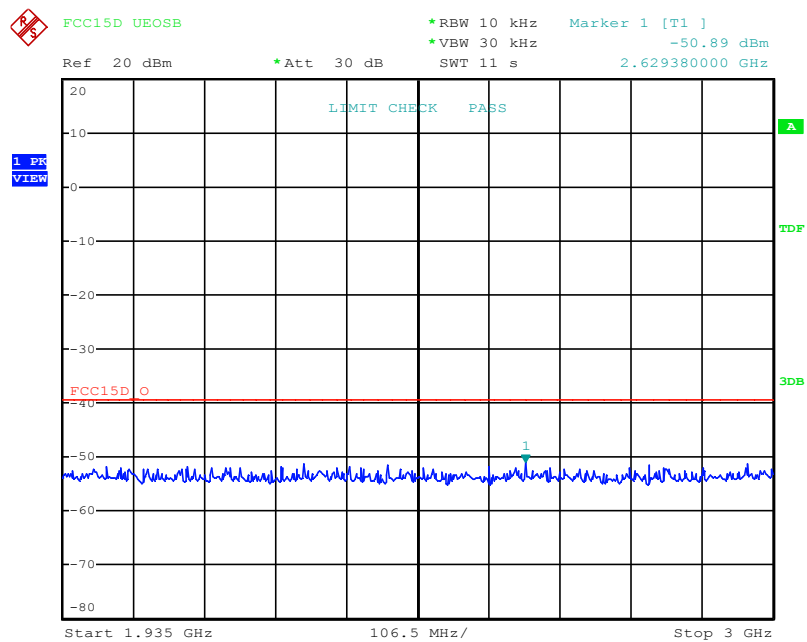
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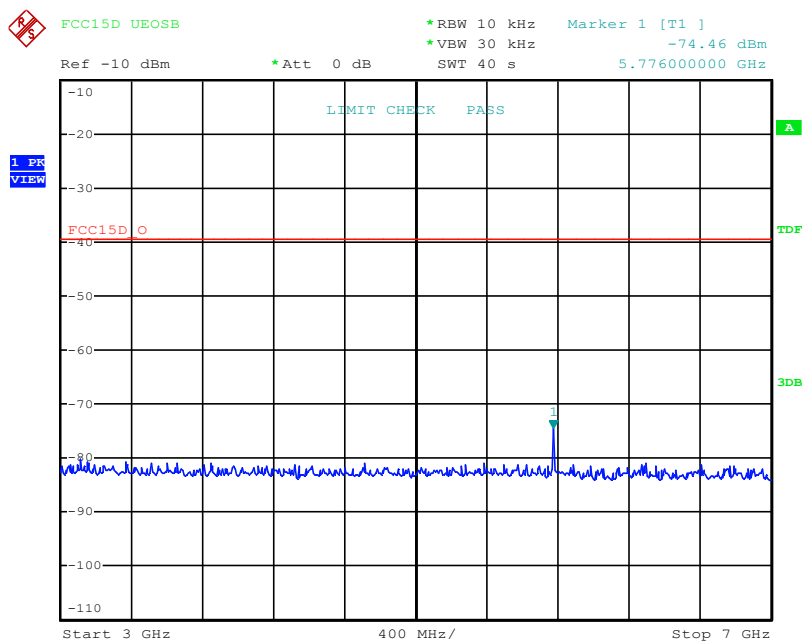
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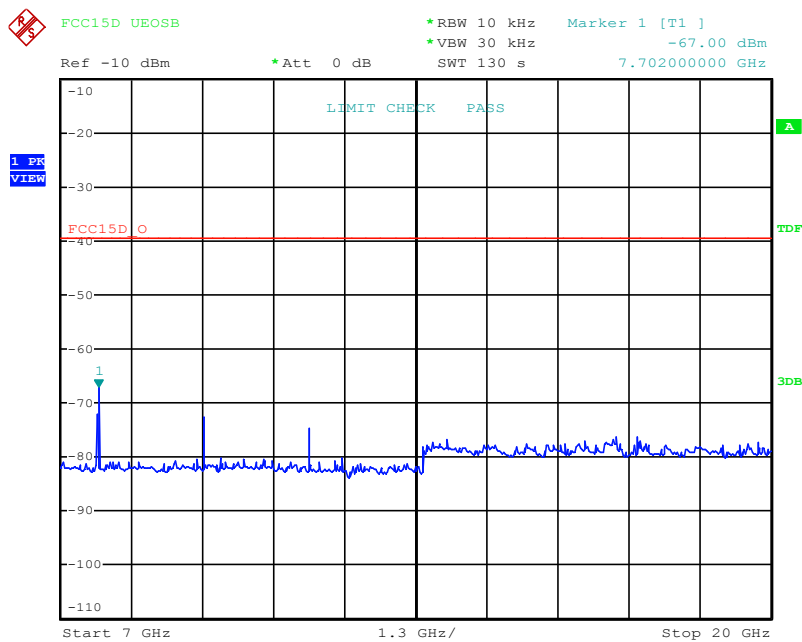
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Date: 26.JUL.2018 11:47:00

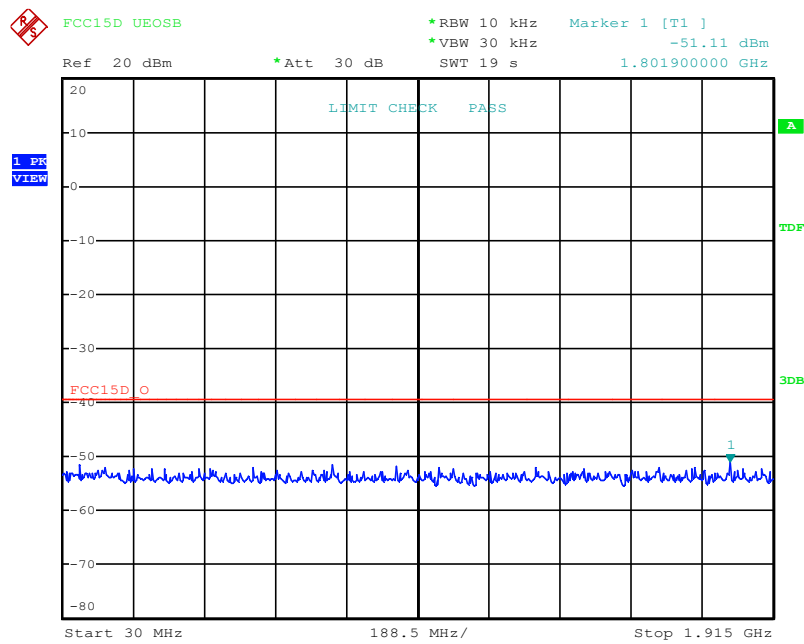


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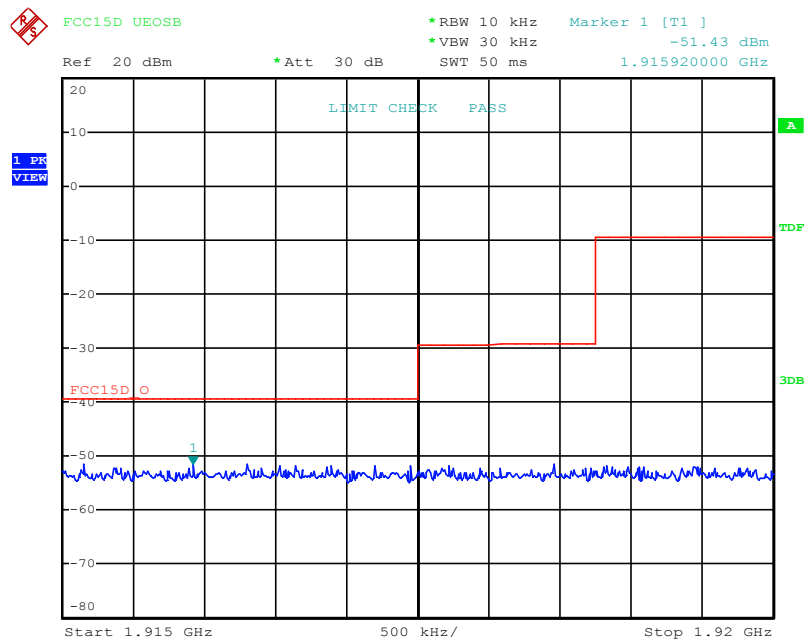


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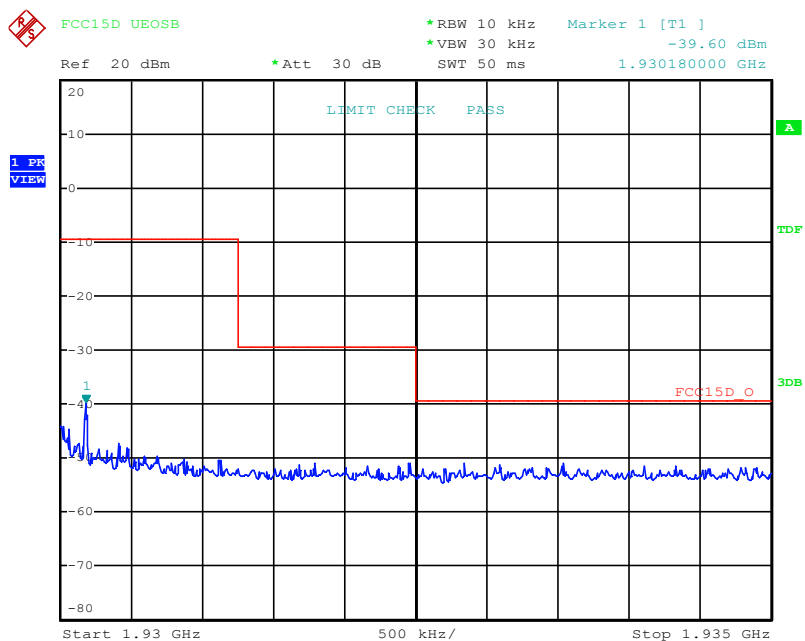
High Channel (Unwanted Emission outside the Sub-band)



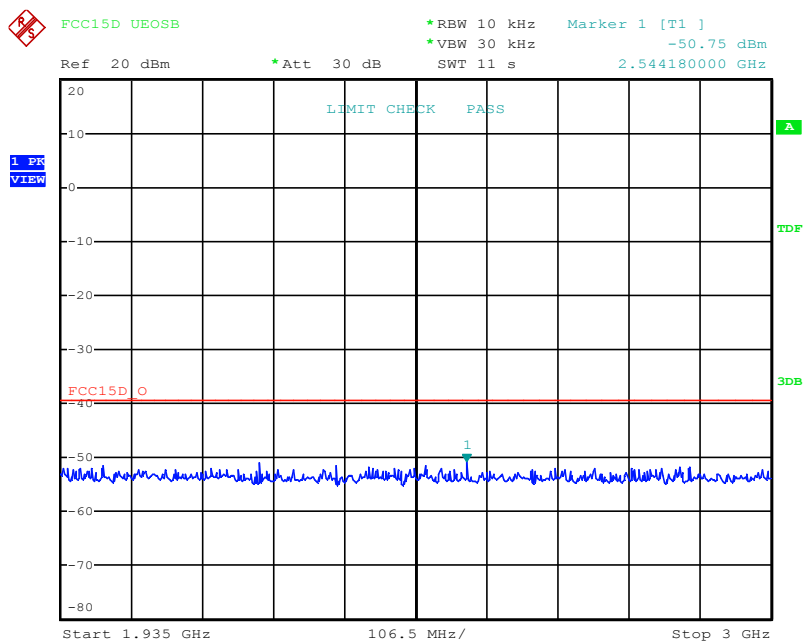
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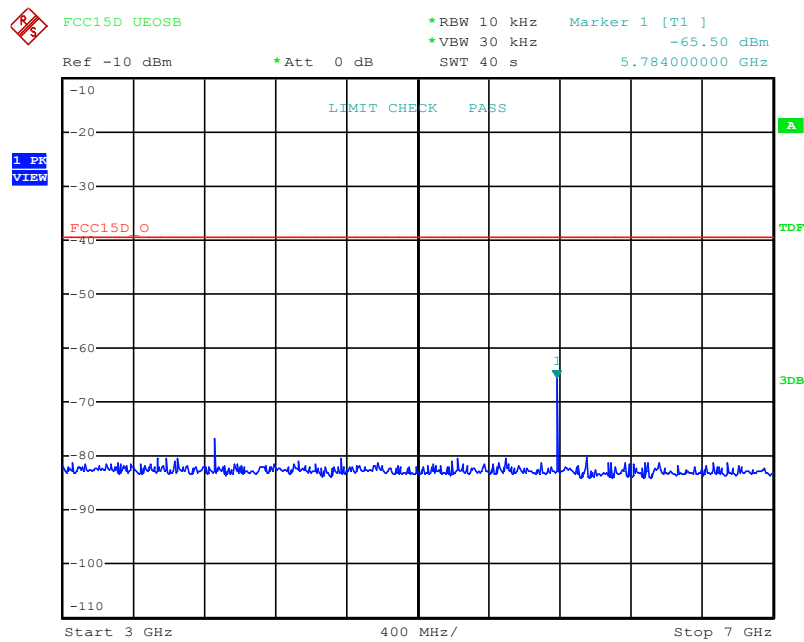
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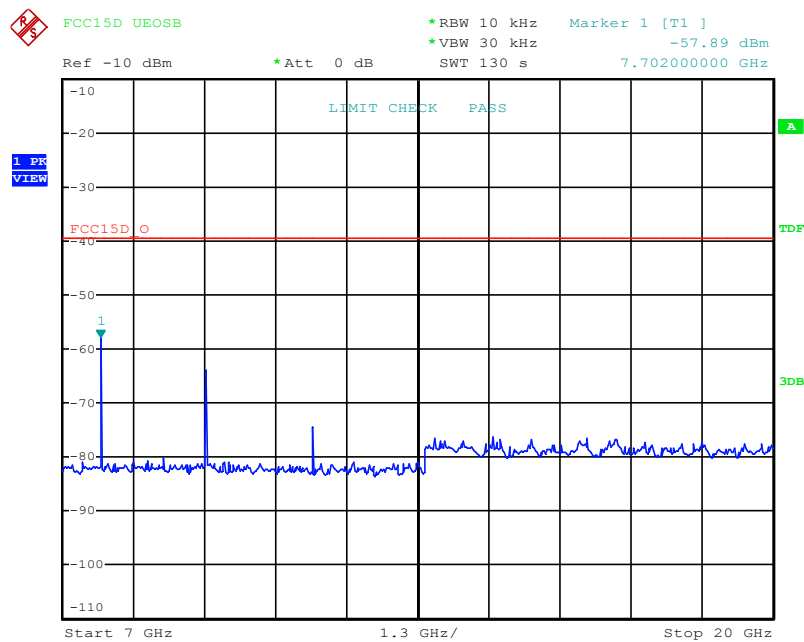
Date: 26.JUL.2018 11:56:33



Date: 26.JUL.2018 11:57:29



Date: 26.JUL.2018 11:59:15



Date: 26.JUL.2018 12:02:24

3.6 Radiated Spurious Emission

3.6.1 Test Equipment

Please refer to section 6 this report.

3.6.2 Test Procedure

The transmitter was placed on a wooden turntable and was transmitting in a non radiating dummy load which was directly connected to the antenna connector. The battery was replaced by monitored voltage source. The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna was height and polarization as well as the EUT azimuth where varied in orders to identify the maximum level of emission from the EUT. The test was performed by placing the EUT on 3 orthogonal axis. The frequency range up to tenth harmonic of the fundamental frequency was investigated. Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution. All tests was performed for the lower, the middle and the highest frequency.

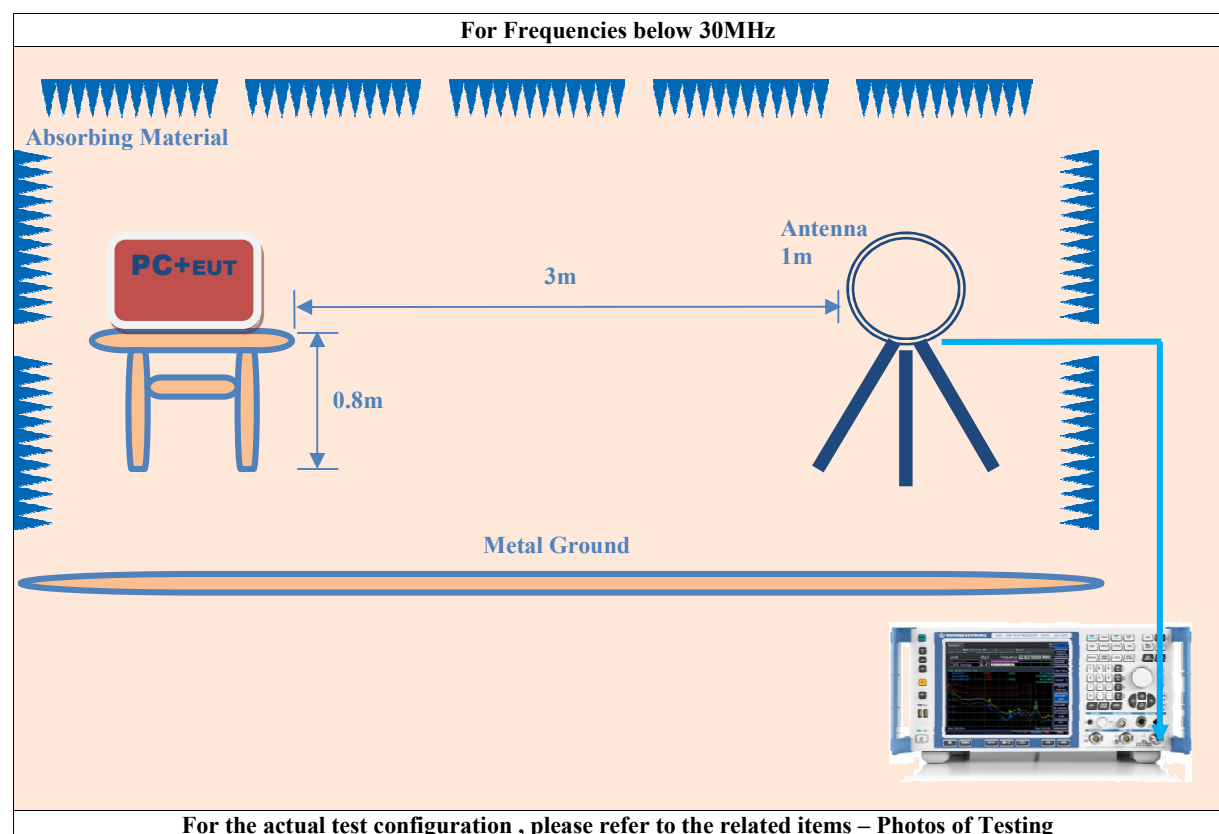
The radiated emission tests were performed in the 3 meters test site, using the setup accordance with the ANSI C63.17. The specification used was the FCC 15§ 15.319(g).

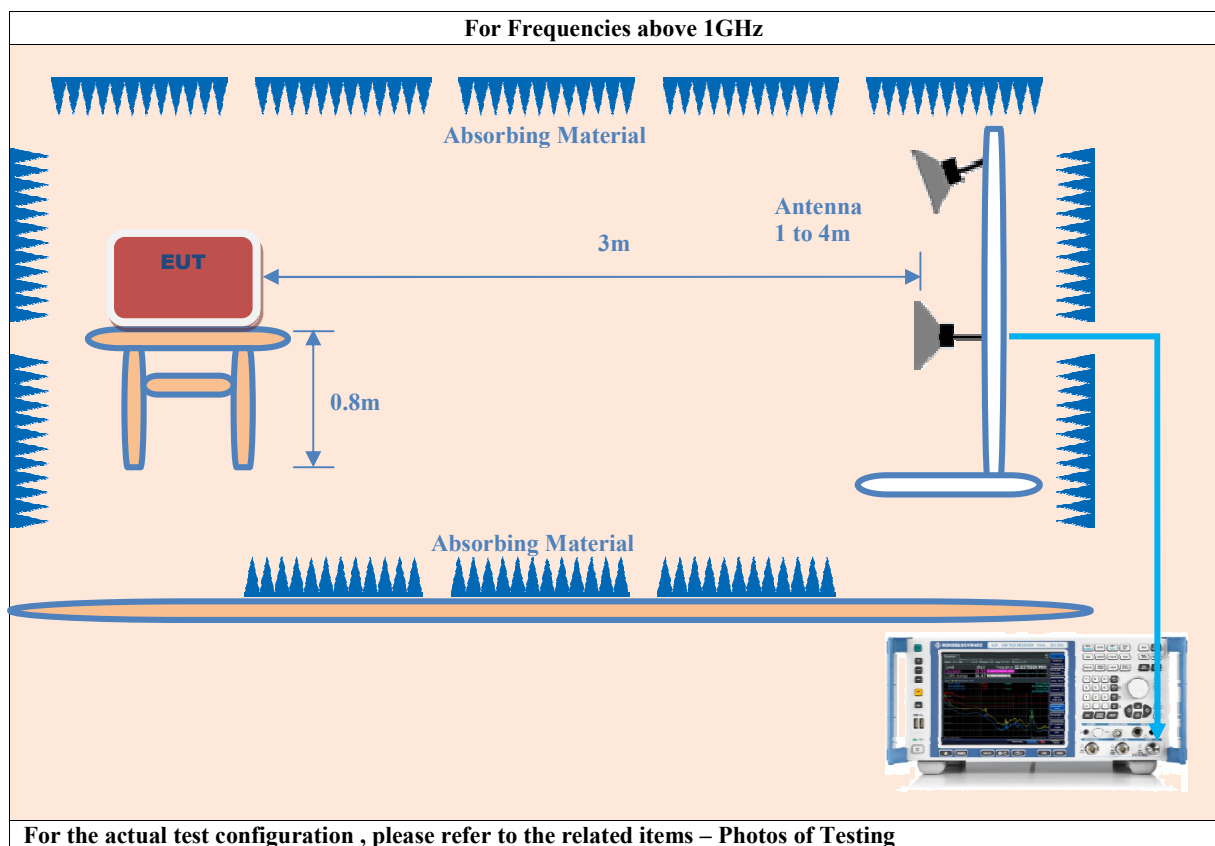
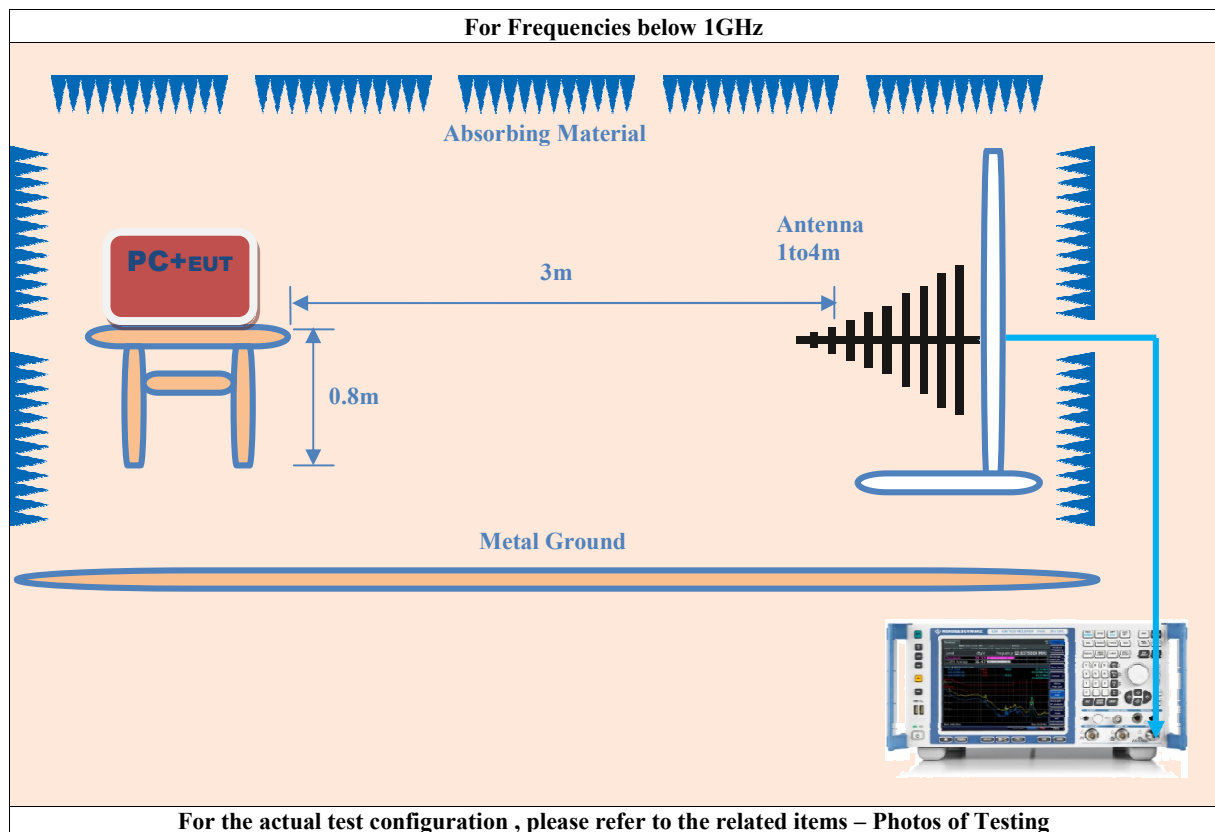
The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

During the radiated emission test, the EMI test receiver & Spectrum Analyzer Setup were set with the following configurations:

Frequency Range	RWB	Video B/W	IF B/W	Detector
30~1000MHz	100kHz	300kHz	120kHz	QP
Above 1GHz	1MHz	1MHz	/	PK
	1MHz	30Hz	/	AV

3.6.3 Test Setup





3.6.4 Configuration of The EUT

Same as section 3.1.4 of this report

3.6.5 EUT Operating Condition

Same as section 3.1.5 of this report

3.6.6 Limit

According to FCC§15.319(g), notwithstanding other technical requirements specified in this subpart, attenuation of emissions below the general emission limits in §15.209 is not required.

3.6.7 Radiated Spurious Emission Test Result

PP

Channel: Low (1921.536 MHz)

Freq. (MHz)	Read Level(dBuV)		Corr. Factor (dB)		Emission (dBuV/m)		Horiz./ Vert.	Limit (dBuV/m)		Margin(dB)	
	PK	AV			PK	AV		PK	AV	PK	AV
1921.40	106.87	-	-0.18	-	106.69	-	Horiz./	-	-	-	-
1921.40	105.39	-	-0.18	-	105.21	-	Vert.	-	-	-	-
3843.10	64.22	-	3.31	-25.78	67.53	41.75	Horiz./	74.00	54.00	-6.47	-12.25
3843.10	60.77	-	3.31	-25.78	64.08	38.30	Vert.	74.00	54.00	-9.92	-15.70
5764.60	45.25	-	13.10	-25.78	58.35	32.57	Horiz./	74.00	54.00	-15.65	-21.43
5764.60	42.14	-	13.10	-25.78	55.24	29.46	Vert.	74.00	54.00	-18.76	-24.54
7686.30	35.36	-	19.20	-25.78	54.56	28.78	Horiz./	74.00	54.00	-19.44	-25.22
7686.30	32.08	-	19.20	-25.78	51.28	-	Vert.	74.00	54.00	-22.72	-

Channel: Mid (1924.992 MHz)

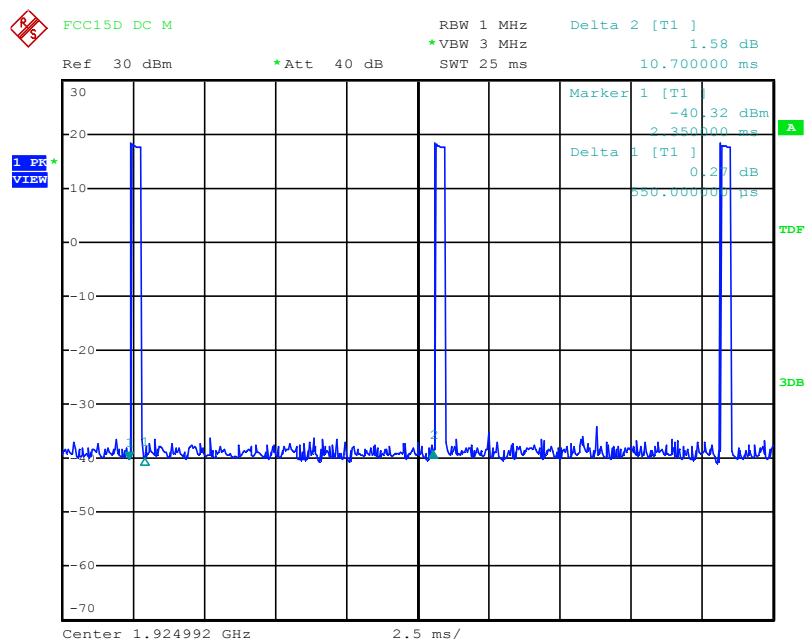
Freq. (MHz)	Read Level(dBuV)		Corr. Factor (dB)		Emission (dBuV/m)		Horiz./ Vert.	Limit (dBuV/m)		Margin(dB)	
	PK	AV			PK	AV		PK	AV	PK	AV
1924.90	106.74	-	-0.18	-	106.56	-	Horiz./	-	-	-	-
1924.90	105.52	-	-0.18	-	105.34	-	Vert.	-	-	-	-
3849.80	64.17	-	3.31	-25.78	67.48	41.70	Horiz./	74.00	54.00	-6.52	-12.30
3849.80	62.03	-	3.31	-25.78	65.34	39.56	Vert.	74.00	54.00	-8.66	-14.44
5774.90	46.72	-	13.10	-25.78	59.82	34.04	Horiz./	74.00	54.00	-14.18	-19.96
5774.90	44.59	-	13.10	-25.78	57.69	31.91	Vert.	74.00	54.00	-16.31	-22.09
7699.60	34.67	-	19.20	-25.78	53.87	-	Horiz./	74.00	54.00	-20.13	-
7699.60	32.34	-	19.20	-25.78	51.54	-	Vert.	74.00	54.00	-22.46	-

Channel: High (1928.448 MHz)

Freq. (MHz)	Read Level(dBuV)		Corr. Factor (dB)		Emission (dBuV/m)		Horiz./ Vert.	Limit (dBuV/m)		Margin(dB)	
	PK	AV			PK	AV		PK	AV	PK	AV
1928.40	106.77	-	-0.18	-	106.59	-	Horiz./	-	-	-	-
1928.40	105.85	-	-0.18	-	105.67	-	Vert.	-	-	-	-
3856.80	63.55	-	3.31	-25.78	66.86	41.08	Horiz./	74.00	54.00	-7.14	-12.92
3856.80	61.56	-	3.31	-25.78	64.87	39.09	Vert.	74.00	54.00	-9.13	-14.91
5785.20	46.84	-	13.10	-25.78	59.94	34.16	Horiz./	74.00	54.00	-14.06	-19.84
5785.20	43.77	-	13.10	-25.78	56.87	31.09	Vert.	74.00	54.00	-17.13	-22.91
7713.60	35.42	-	19.20	-25.78	54.62	28.84	Horiz./	74.00	54.00	-19.38	-25.16
7713.60	33.65	-	19.20	-25.78	52.85	-	Vert.	74.00	54.00	-21.15	-

- Note:**
- (1) All Reading Levels below 1GHz are Quasi-Peak, above are peak and average value.
 - (2) Emission Level = Reading Level + Probe Factor + Cable Loss – Amplifier Factor
 - (3) Receiver setting (Peak Detector) : RBW=1MHz; VBW=1MHz; Span=100MHz
 - (4) Receiver setting (AVG Detector): RBW=1MHz; VBW=30Hz; Span=20MHz
 - (5) The average measurement was not performed when the peak measured data under the limit of average detection. If the readings given are average, peak measurement should also be supplied.
 - (6) $AV = PK + 20 \cdot \lg(\text{Duty Cycle})$
Duty Cycle = $T_{on}/T_p \cdot 100\%$,
 $T_{on} = 550\mu s$,
 $T_p = 10.70ms$
Duty Cycle = Duty cycle factor = $20 \lg(\text{Duty Cycle}) = -25.78$

Duty Cycle



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3.7 Carrier Frequency Stability

3.7.1 Test Equipment

Please refer to section 6 this report.

3.7.2 Test Procedure

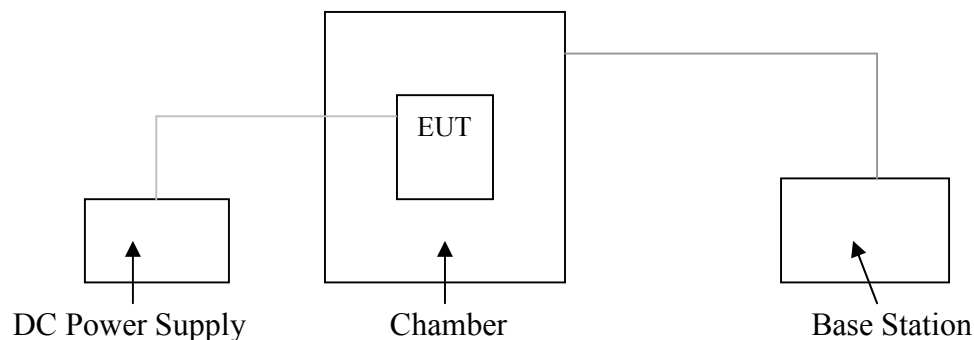
ANSI C63.17, clause 6.2.1. The Frequency Stability is measured with the CMD60. The CMD60 was logged by a computer programmed to get new readings as fast as possible (about 3 readings per second) over the noted time period or number of readings. The peak-to-peak difference was recorded and the mean value and deviation in ppm was calculated.

The Carrier Frequency Stability over Power Supply Voltage and over Temperature is measured with a Frequency Domain Analyzer in histogram mode.

Temperature	Supply Voltage
20°C	85-115% or new batteries
-20°C	Normal
+50°C	Normal

Note: Use the lowest temperature at which the EUT is specified to operate if it is above -20 °C.

3.7.3 Test Setup



3.7.4 Configuration of The EUT

Same as section 3.1.4 of this report

3.7.5 EUT Operating Condition

Same as section 3.1.5 of this report

3.7.6 Limit

Ref. FCC 15.323(e), RSS-213 Issue 3, clause 5.3

The frequency stability of the carrier frequency of the intentional radiator shall be maintained within ± 10 ppm over 1 hour or the interval between channel access monitoring, whichever is shorter. The frequency stability shall be maintained over a temperature variation of -20°C to $+50^{\circ}\text{C}$ at normal supply voltage, and over a variation in the primary supply voltage of 85 percent to 115 percent of the rated supply voltage at a temperature of 20°C . For equipment that is capable only of operating from a battery, the frequency stability tests shall be performed using a new battery without any further requirement to vary supply voltage

3.7.7 Frequency Stability Test Result

PP

Frequency Stability over Power Supply Voltage at Nominal Temperature

Voltage	Channel Frequency (MHz)	Measured Frequency Offset (kHz)	Measured Frequency Offset (ppm)	Limit (ppm)
V_{nom}	1924.992	0.00	0.00	± 10
85% of V_{nom}	1924.992	-1.50	-0.78	± 10
115% of V_{nom}	1924.992	-2.50	-1.30	± 10

Frequency Stability over Temperature

Temperature (°C)	Channel Frequency (MHz)	Measured Frequency Offset (kHz)	Measured Frequency Offset (ppm)	Limit (ppm)
20	1924.992	0.00	0.00	± 10
-20	1924.992	2.00	1.04	± 10
50	1924.992	1.00	0.52	± 10

3. 8 FCC§15.323 (c) (e) & §15.319(f) / RSS-213 Issue 3, clause 5.2– Specific Requirements for UPCS Device

3.8.1 Frame Repetition Stability Part15 .323 (e) / RSS-213 Issue 3, clause 5.2

Test Procedure

According to ANSI C63.17, clause 6.2.2., The envelope of the RF signal from the EUT is detected with a Crystal Detector and the mean and standard deviation of the frame repetition frequency is then gated over 100 frames and measured with a Frequency Domain Analyzer. The frame repetition stability is 3 times the standard deviation.

Limit

Frame Repetition Stability	± 10 ppm (TDMA)
----------------------------	-----------------

Ref. FCC 15.323(e), RSS-213 Issue 3, clause 5.2

Test Result

PP

Frame Repetition Stability (ppm)	Limit (ppm)	Result (Pass/Fail)
-0.35	± 10	Pass

3.8.2 Frame Period and Jitter Part15 .323 (e) / RSS-213 Issue 3, clause 5.2

Test Procedure

According to ANSI C63.17, clause 6.2.3.

Limit

Ref. FCC 15.323(e), RSS-213 Issue 3, clause 5.2

The frame period (a set of consecutive time slots in which the position of each time slot can be identified by reference to a synchronizing source) of an intentional radiator operating in these sub-bands shall be 20 milliseconds or 10 milliseconds/X where X is a positive whole number.

Frame Period	20 or 10 ms
Max Jitter	25 μs
3 times St.Dev of Jitter	12.5 μs

Test Result

PP

Max.pos. Jitter (us)	Max. neg. Jitter (us)	Frame period (us)	Limit	
			Frame Period (ms)	Jitter(μs)
0.12	-0.06	10.00000	20 or 10/X	25

Note: X is a positive whole number.

3.8.3 Lower Monitoring Threshold Part15.323 (c) (2) / RSS-213 Issue 3, clause 5.2**Test Procedure**

Measurement method according to ANSI C63.17 clause 7.3.1

Limit

The monitoring threshold must not be more than 30 dB above the thermal noise power for a bandwidth equivalent to the emission bandwidth used by the device.

The Lower Threshold is applicable for systems which have defined less than 40 duplex system access channels. The Upper Threshold is applicable for systems with more than 40 duplex system access channels and that implements the Least Interfered Channel Procedure (LIC).

Test Result

Not Applicable. For the EUT which support LIC there is no need to measure lower threshold because it is automatically met by LIC procedure.

3.8.4 Least Interfered Channel (LIC) Selection, FCC Part15.323 (c) (5) / RSS-213 Issue 3, clause 5.2**Test Procedure**

Measurement method according to ANSI C63.17 clause 7.3.2, 7.3.3, 7.3.4

If access to spectrum is not available as determined by the above, and a minimum of 40 duplex system access channels are defined for the system, the time and spectrum windows with the lowest power level below a monitoring threshold of 50 dB above the thermal noise power determined for the emission bandwidth may be accessed.

Calculation of monitoring threshold limits for isochroous devices:

Lower threshold: $TL = -174 + 10\log_{10}B + \mu + P_{MAX} - PEUT$ (dBm)

Upper threshold: $TU = -174 + 10\log_{10}B + \mu + P_{MAX} - PEUT$ (dBm)

Where: B=Emission bandwidth (Hz)

μ =dB the threshold may exceed thermal noise (30 for TL & 50 for TU)

$P_{MAX} = 5\log_{10}B - 10$ (dBm)

$PEUT$ =Transmitted power (dBm)

Limit

FCC 15.323, RSS-213 Issue 3, clause 5.2

PP

Monitor Threshold	B (MHz)	MU (dB)	P MAX (dBm)	PEUT (dBm)	Threshold (dBm)
T_L	1.470	30.00	20.84	18.84	-80.33
T_U	1.470	50.00	20.84	18.84	-60.33

The EUT must not transmit until the interference level is less than or equal to:

Measured Threshold Level $\leq T_U$

Where: T_U =Upper threshold level

Test Result**PP**

Monitor threshold	Measured Threshold Level	Limit (dBm)
Lower Threshold (dBm)	N/A	-80.33
Upper Threshold (dBm)	N/A	-60.33

Note: N/A Not applicable- EUT which supports at least of 40 duplex system access channels and implements Least Interfered Channel (LIC) algorithm is permitted to use an upper monitoring threshold.

3.8.5 Monitoring Bandwidth, FCC Part 15.323 (c) (7) / RSS-213 Issue 3, clause 5.2**Test Procedure**

Simple Compliance Test, ANSI C63.17, clause 7.4.1

More Detailed Test, ANSI C63.17, clause 7.4.2

The test is passed if either the Simple Compliance Test or the More Detailed test is passed.

During this test the spectrum analyzer is observed visually to see if the EUT transmits or not.

Limit FCC 15.323(c)(7), RSS-213 Issue 3, clause 5.2:

The monitoring system bandwidth must be equal to or greater than the emission bandwidth of the intended transmission.

Test Result**PP**

Test Performed	Observation	Verdict
Simple Compliance test, at $\pm 30\%$ of B	No transmissions	Pass
More Detailed Test, at -6 dB points	N/A	N/A
More Detailed Test, at -12 dB points	N/A	N/A

3.8.6 Reaction Time and Monitoring Interval / RSS-213 Issue 3, clause 5.2**Test Procedure**

ANSI C63.17, clause 7.5

Limit FCC 15.323(c)(1), (5) and (7), RSS-213 Issue 3, clause 5.2:

The maximum reaction time must be less than $50 \times \text{SQRT}(1.25/\text{emission bandwidth in MHz})$ microseconds for signals at the applicable threshold level but shall not be required to be less than 50 microseconds.

If a signal is detected that is 6 dB or more above the applicable threshold level, the maximum reaction time shall be $35 \times \text{SQRT}(1.25/\text{emission bandwidth in MHz})$ microseconds but shall not be required to be less than 35 microseconds.

Test Result

By administrative commands and out-of-operating region interference, the EUT is restricted to operate on a single carrier frequency.

Time-synchronized pulsed interference was then applied on the carrier at pulsed levels TU + UM to check that the EUT does not transmit at all. The level was raised 6 dB for part d) with 35 μs pulses.

The pulses are synchronized with the EUT timeslots and applied centered within all timeslots

PP

Pulse Width, ref. to ANSI C63.17 clause 7.5	Observation	Verdict
c) > largest of 50 μs and $50 \times \text{SQRT}(1.25/B)$	No transmissions	Pass
d) > largest of 35 μs and $35 \times \text{SQRT}(1.25/B)$, and with interference level raised 6 dB	No transmissions	Pass

Note:: Since B is larger than 1.25 MHz the test was performed with pulse lengths of 50 μs and 35 μs

3.8.7 Time and Spectrum Window Access Procedure / RSS-213 Issue 3, clause 5.2**Test Procedure**

This requirement is only for EUTs which transmit unacknowledged control and signaling information.
Timing for EUTs using control and signaling channel type transmissions: ANSI C63.17, clause 8.1

Limit

FCC 15.323(c)(4):

Once access to specific combined time and spectrum windows is obtained an acknowledgement from a system participant must be received by the initiating transmitter within one second or transmission must cease. Periodic acknowledgements must be received at least every 30 seconds or transmission must cease. Channels used exclusively for control and signaling information may transmit continuously for 30 seconds without receiving an acknowledgement, at which time the access criteria must be repeated.

FCC 15.323(c)(6):

If the selected combined time and spectrum windows are unavailable, the device may either monitor and select different windows or seek to use the same windows after waiting an amount of time, randomly chosen from a uniform random distribution between 10 and 150 milliseconds, commencing when the channel becomes available

Test Result

Access Criteria, ref. to ANSI C63.17 clause 8.1.1	Observation	Verdict
b) Check that the EUT transmits on the interference free time-slot	N/A	N/A
b) The EUT must terminate or pause in its repetitive transmission of the control and signalling channel on the open channel to repeat the access criteria not less frequently than every 30 s	N/A	N/A

If FCC 15.323(c)(6) option, If Random Waiting Interval is NOT implemented

Access Criteria, ref. to ANSI C63.17 clause 8.1.2	Observation	Verdict
b) Check that the EUT changes to an interference-free slot when interference is introduced on the time slot in use	N/A	N/A

If FCC 15.323(c)(6) option, Only if Random Waiting Interval is implemented

Access Criteria, ref. to ANSI C63.17 clause 8.1.3	Observation	Verdict
b-d) Check that the EUT uses random waiting interval before continuing transmission on an interfered time slot	N/A	N/A

Note: The tested EUT does not transmit unacknowledged control and signaling information.

3.8.8 Acknowledgements and Transmission Duration FCC Part15.323 (c) (3) & (c) (4) / RSS-213 Issue 3, clause 5.2**Test Procedure**

Acknowledgements: ANSI C63.17, clause 8.2.1

Transmission Duration: ANSI C63.17, clause 8.2.2

During the test Initial transmission without acknowledgements the signal from the EUT to the companion device is blocked by circulators in addition to the tunable attenuator.

The test Transmission time after loss of acknowledgements is performed by cutting-off the signal from the companion device by a RF switch and measuring the time until the EUT stops transmitting..

The Transmission Duration test is performed by monitoring the slot in use and measuring the time until the EUT changes to a different slot.

Limits:**FCC 15.323(c)(4), RSS-213 Issue 3, clause 5.2:**

Once access to specific combined time and spectrum windows is obtained an acknowledgement from a system participant must be received by the initiating transmitter within one second or transmission must cease. Periodic acknowledgements must be received at least every 30 seconds or transmission must cease. Channels used exclusively for control and signaling information may transmit continuously for 30 seconds without receiving an acknowledgement, at which time the access criteria must be repeated.

FCC 15.323(c)(6), RSS-213 Issue 3, clause 5.2:

If the selected combined time and spectrum windows are unavailable, the device may either monitor and select different windows or seek to use the same windows after waiting an amount of time, randomly chosen from a uniform random distribution between 10 and 150 milliseconds, commencing when the channel becomes available

Test Result**PP**

Acknowledgements

Test ref. to ANSI C63.17 clause 8.2.1	Observation	Verdict
a) Initial transmission without acknowledgements	0.5 ms	Pass
c) Transmission time after loss of acknowledgements	5.0 sec	Pass

Transmission Duration

Test ref. to ANSI C63.17 clause 8.2.2	Observation	Verdict
b) Transmission duration on same time and frequency window	Only for initiating device that controls which time slot is used	N/A

3.8.9 Dual Access Criteria Check, FCC Part15.323 (c) (10) / RSS-213 Issue 3, clause 5.2**Test Procedure**

EUTs that does not implement the Upper Threshold: ANSI C63.17, clause 8.3.1

EUTs that implement the Upper Threshold: ANSI C63.17, clause 8.3.2

This test is required for equipment that uses the access criteria in FCC 15.323(c)(10).

Limits, FCC 15.323(c)(10), RSS-213 Issue 3, clause 5.2:

An initiating device may attempt to establish a duplex connection by monitoring both its intended transmit and receive time and spectrum windows. If both the intended transmit and receive time and spectrum windows meet the access criteria, then the initiating device can initiate a transmission in the intended transmit time and spectrum window. If the power detected by the responding device can be decoded as a duplex connection signal from the initiating device, then the responding device may immediately begin transmitting on the receive time and spectrum window monitored by the initiating device.

Test Result**EUTs that implements the Upper Threshold:**

Test ref. to ANSI C63.17 clause 8.3.2	Observation	Verdict
b) EUT is restricted to a single carrier fl for TDMA systems. The Test is Pass if EUT can transmit	N/A	N/A
c) d) Transmission on interference-free receive time/spectrum window	N/A	N/A
e) f) Transmission on interference-free transmit time/spectrum window	N/A	N/A
g) Transmission not possible on any time/spectrum window	N/A	N/A

3.8.10 Alternative monitoring interval for co-located devices, FCC Part 15.323 (c) (11) / RSS-213 Issue 3, clause 5.2

An initiating device that is prevented from monitoring during its intended transmit window due to monitoring system blocking from the transmissions of a co-located (within one meter) transmitter of the same system, may monitor the portions of the time and spectrum windows in which they intend to receive over a period of at least 10 milliseconds. The monitored time and spectrum window must total at least 50 percent of the 10 millisecond frame interval and the monitored spectrum must be within 1.25 MHz of the center frequency of channel(s) already occupied by that device or co-located co-operating devices. If the access criteria is met for the intended receive time and spectrum window under the above conditions, then transmission in the intended transmit window by the initiating device may commence.

Test Procedure

Measurement method according to ANSI C63.17 clause 8.4

Test Result

The manufacturer declares that this provision is not utilized by the EUT.

3.8.11 Automatic Discontinuation of Transmission, FCC Part 15.319(f) / RSS-213 Issue 3, clause 5.2**Test Procedure**

The device shall automatically discontinue transmission in case of either absence of information to transmit or operational failure. The provisions in this section are not intended to preclude transmission of control and signaling information or use of repetitive codes used by certain digital technologies to complete frame or burst intervals.

Requirements, FCC 15.319(f), RSS-213 Issue 3, Clause 5.2:

The device shall automatically discontinue transmission in case of either absence of information to transmit or operational failure. These provisions are not intended to preclude transmission of control and signaling information or use of repetitive codes used by certain digital technologies to complete frame or burst intervals.

Test Result

Meet the requirement; please refer to the declaration provided by manufacturer.

3.8.12 Monitoring Time FCC 15.323 (c) (1) / RSS-213 Issue 3, clause 5.2

Immediately prior to initiating transmission, devices must monitor the combined time and spectrum window in which they intend to transmit. For a period of at least 10 milliseconds for systems designed to use a 10 milliseconds or shorter frame period or at least 20 milliseconds for systems designed to use a 20 milliseconds frame period

Test Procedure

Measurement method according to ANSI C63.17 clause 7.3.4

Test Result

PP

EUT monitors the combined time and spectrum window prior to initiation of transmission. Test result is following

Interference (Refer to ANSI C63.17 clause 7.3.4)	Reaction of EUT	Results
1) Apply the interference on f1 at level TU+UM, and no interference on f2. Initiate transmission and verify the transmission on f2.	EUT transmits on f2	Pass
2) Apply the interference on f2 at level TU+UM, at the same time, no interference on f1. After about 20ms, initiate transmission and verify the transmission on f1.	EUT transmits on f1	Pass

3.8.13 Monitoring Antenna, FCC Part15.323 (c) (8) / RSS-213 Issue 3, clause 5.2

The monitoring system shall use the same antenna used for transmission, or an antenna that yields equivalent reception at that location.

Test Procedure

Measurement method according to ANSI C63.17 paragraph 4

Test Result

The antenna of the EUT used for transmission is the same interior antenna that used for monitoring.

3.8.14 Monitoring threshold relation FCC 15.323(c) (9) / RSS-213 Issue 3, clause 5.2

Devices that have a power output lower than the maximum permitted under the rules can increase their monitoring detection threshold by one decibel for each one decibel that the transmitter power is below the maximum permitted.

Test Procedure

Measurement method according to ANSI C63.17 paragraph 4

Test Result

Not apply based on 15.323 (c) (5)

3.8.15 Fair Access, FCC Part 15.323 (c) (12) / RSS-213 Issue 3, clause 5.2

The provisions of FCC Part15.323(c)(10) or (c)(11) shall not be used to extend the range of spectrum occupied over space or time for the purpose of denying fair access to spectrum to other devices.

Test Result

The manufacturer declares that this device does not use any mechanisms as provided by Part15.323 (c) (10) or (c) (11) to extend the range of spectrum occupied over space or time for the purpose of denying fair access to spectrum to other device.

4. Photos of Testing

4. 1 Emission Test View

Please refer to Exhibits_ Test Setup Photos

4. 2 EUT Detailed Photographs

Please refer to Exhibits_External Photos & Internal Photos

5. FCC ID Label

Please refer to Exhibits_ ID Label & Location Info

6. Test Equipment

The following test equipments were used during the radiated & conducted emission test:

Equipment/ Facilities	Manufacturer	Model #	Serial No.	Cal/Char Date	Due Date
Turntable	Innco systems GmbH	CT-0801	N/A	NCR	NCR
Antenna Tower	Innco systems GmbH	MA-4640-XP-ET	N/A	NCR	NCR
Controller	Innco systems GmbH	CO3000	955/38850716L	NCR	NCR
Pre-Amplifier	Agilent	87405C	MY47010722	Dec.6, 2017	Dec.6, 2019
Pre-Amplifier	Com-Power	PAM-840	N/A	Dec.6, 2017	Dec.6, 2019
Horn Antenna	SCHWARZBECK	BBHA 9170	N/A	Dec.6, 2017	Dec.6, 2019
EMI Test Receiver	Rohde & Schwarz	ESR7	101091	Dec.6, 2016	Dec.6, 2018
Spectrum Analyzer	Rohde & Schwarz	FSP40	100273	Dec.14, 2017	Dec.14, 2019
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100022	Feb.21, 2018	Feb.21, 2020
Trilog-Super Broadband Antenna	SCHWARZBECK	VULB9161	9161-4079	August 27, 2016	August 27, 2018
Broad-Band Horn Antenna	SCHWARZBECK	BBHA 9120D	9120D-565	August 19, 2016	August 19, 2018
AMN	Rohde & Schwarz	ESH3-Z5	100197	Dec.25, 2017	Dec.25, 2019
AMN	CYBERTEK	EM5040A	E115040054	Sep.6, 2016	Sep.6, 2018
Pulse Limiter	SCHWARZBECK	VTSD 9561-F	9604	Dec.25, 2017	Dec.25, 2019
ISN	SCHWARZBECK	NTFM 8158 CAT3	CAT3-8158-0010	Dec.25, 2017	Dec.25, 2019
ISN	SCHWARZBECK	NTFM 8158 CAT5	CAT5-8158-0009	Dec.25, 2017	Dec.25, 2019
ISN	SCHWARZBECK	NTFM 8158 CAT6	CAT6-8158-0012	Dec.25, 2017	Dec.25, 2019
KMO Shielded Room	KMO	KMO-001	N/A	NCR	NCR
Coaxial Cable with N-Connectors	SCHWARZBECK	AK9515H	95549	Sep.18, 2017	Sep.18, 2019
Digital Radio Communication Tester	Rohde & Schwarz	CMD60	1050.9008.60	Dec.14, 2017	Dec.14, 2019
3m Anechoic Chamber	KMO	KMO-3AC	N/A	Dec.23, 2017	Dec.23, 2019
Temperature Chamber	TABAI	PSL-4GTW	N/A	Feb.10, 2017	Feb.10, 2019